Medicine Lodge Subbasin Assessment and TMDLs

IDAHO DEPARTMENT OF ENVIRONMENTAL QUALITY

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References Cited

33 USC § 1251-1387. Federal water pollution control act (Clean Water Act).

40 CFR 130. Water quality planning and management.

American Geologic Institute. 1962. Dictionary of geologic terms. Doubleday and Company: Garden City, NY. 545 pp.

Armantrout, N. B. (compiler). 1998. Glossary of aquatic habitat inventory terminology. American Fisheries Society: Bethesda, MD. 136 pp.

Batt, P. E. 1996. Governor Philip E. Batt's Idaho bull trout conservation plan. State of Idaho, Office of the Governor: Boise, ID. 20 pp + appendices.

EPA. 1996. Biological criteria: technical guidance for streams and small rivers. EPA 822-B-96-001. U.S. Environmental Protection Agency, Office of Water: Washington, DC. 162 pp.

EPA. 1997. Guidelines for preparation of the comprehensive state water quality assessments (305(b) reports) and electronic updates: supplement. EPA-841-B-97-002B. U.S. Environmental Protection Agency: Washington, DC. 105pp.

Grafe, C. S., M. J. McIntyre, C. A. Mebane, and D. T. Mosier. 2000. The Idaho Department of Environmental Quality water body assessment guidance, second edition. Idaho Department of Environmental Quality: Boise, ID. 114 pp.

Hughes, R. M. 1995. Defining acceptable biological status by comparing with reference condition. *In* Davis, W.S. and T.P. Simon (editors). Biological assessment and criteria: tools for water resource planning. CRC Press: Boca Raton, FL. 31-48 pp.

Idaho Code § 39.3611. Development and implementation of total maximum daily load or equivalent processes.

Idaho Code § 3615. Creation of watershed advisory groups.

IDAPA 58.01.02. Idaho water quality standards and wastewater treatment requirements.

Karr, J. R. 1991. Biological integrity: a long-neglected aspect of water resource management. Ecological Applications. 1:66-84.

Public Law 92-50. Federal water pollution control act (Clean Water Act).

Public Law 100-4. Water quality act of 1987.

Rand, G. W. (editor). 1995. Fundamentals of aquatic toxicology: effects, environmental fate, and risk assessment, second edition. Taylor and Francis: Washington, DC. 1125 pp.

Strahler, A. N. 1957. Quantitative analysis of watershed geomorphology. American Geophysical Union Transactions. 38:913-920.

USGS. 1987. Hydrologic unit maps. United States Geological Survey water-supply paper 2294. U.S. Geological Survey: Denver, CO. 63 pp.

Water Environment Federation. 1987. The Clean Water Act of 1987. Alexandria VA. 318 pp.

Greenborg, A. E., L. S. Clescevi, and A. D. Eaton (editors). 1992. Standard methods for the examination of water and wastewater, 18th edition. American Public Health Association: Washington, DC.

Glossary

305(b)	Refers to section 305 subsection "b" of the Clean Water Act. 305(b) generally describes a report of each state's water quality, and is the principle means by which the U.S. Environmental Protection Agency, congress, and the public evaluate whether U.S. waters meet water quality standards, the progress made in maintaining and restoring water quality, and the extent of the remaining problems.
303(d)	Refers to section 303 subsection "d" of the Clean Water Act. 303(d) requires states to develop a list of water bodies that do not meet water quality standards. This section also requires total maximum daily loads (TMDLs) be prepared for listed waters. Both the list and the TMDLs are subject to U.S. Environmental Protection Agency approval.
Acre-Foot	A volume of water that would cover an acre to a depth of one foot. Often used to quantify reservoir storage and the annual discharge of large rivers.
Adsorption	The adhesion of one substance to the surface of another. Clays, for example, can adsorb phosphorus and organic molecules.
Aeration	A process by which water becomes charged with air directly from the atmosphere. Dissolved gases, such as oxygen, are then available for reactions in water.
Aerobic	Describes life, processes, or conditions that require the presence of oxygen.
Assessment Database (ADB)	The ADB is a relational database application designed for the U.S. Environmental Protection Agency for tracking water quality assessment data, such as use attainment and causes and sources of impairment. States need to track this information and many other types of assessment data for thousands of water bodies, and integrate it into meaningful reports. The ADB is designed to make this process accurate, straightforward, and user-friendly for participating states, territories, tribes, and basin commissions.

Adfluvial	Describes fish whose life history involves seasonal migration from lakes to streams for spawning.
Adjunct	In the context of water quality, adjunct refers to areas directly adjacent to focal or refuge habitats that have been degraded by human or natural disturbances and do not presently support high diversity or abundance of native species.
Alevin	A newly hatched, incompletely developed fish (usually a salmonid) still in nest or inactive on the bottom of a water body, living off stored yolk.
Algae	Non-vascular (without water-conducting tissue) aquatic plants that occur as single cells, colonies, or filaments.
Alluvium	Unconsolidated recent stream deposition.
Ambient	General conditions in the environment. In the context of water quality, ambient waters are those representative of general conditions, not associated with episodic perturbations, or specific disturbances such as a wastewater outfall (Armantrout 1998, EPA 1996).
Anadromous	Fish, such as salmon and sea-run trout, that live part or the majority of their lives in the salt water but return to fresh water to spawn.
Anaerobic	Describes the processes that occur in the absence of molecular oxygen and describes the condition of water that is devoid of molecular oxygen.
Anoxia	The condition of oxygen absence or deficiency.
Anthropogenic	Relating to, or resulting from, the influence of human beings on nature.

Anti-Degradation	Refers to the U.S. Environmental Protection Agency's interpretation of the Clean Water Act goal that states and tribes maintain, as well as restore, water quality. This applies to waters that meet or are of higher water quality than required by state standards. State rules provide that the quality of those high quality waters may be lowered only to allow important social or economic development and only after adequate public participation (IDAPA 58.01.02.051). In all cases, the existing beneficial uses must be maintained. State rules further define lowered water quality to be 1) a measurable change, 2) a change adverse to a use, and 3) a change in a pollutant relevant to the water's uses (IDAPA 58.01.02.003.56).
Aquatic	Occurring, growing, or living in water.
Aquifer	An underground, water-bearing layer or stratum of permeable rock, sand, or gravel capable of yielding of water to wells or springs.
Assemblage (aquatic)	An association of interacting populations of organisms in a given water body; for example, a fish assemblage, or a benthic macroinvertebrate assemblage (also see Community) (EPA 1996).
Assimilative Capacity	The ability to process or dissipate pollutants without ill effect to beneficial uses.
Autotrophic	An organism is considered autotrophic if it uses carbon dioxide as its main source of carbon. This most commonly happens through photosynthesis.
Batholith	A large body of intrusive igneous rock that has more than 40 square miles of surface exposure and no known floor. A batholith usually consists of coarse-grained rocks such as granite.
Bedload	Material (generally sand-sized or larger sediment) that is carried along the streambed by rolling or bouncing.
Beneficial Use	Any of the various uses of water, including, but not limited to, aquatic aquatic life, recreation, water supply, wildlife habitat, and aesthetics, which are recognized in water quality standards.

Beneficial Use Reconnaissance Program (BURP)	A program for conducting systematic biological and physical habitat surveys of water bodies in Idaho. BURP protocols address lakes, reservoirs, and wadeable streams and rivers.
Benthic	Pertaining to or living on or in the bottom sediments of a water body.
Benthic Organic Matter	The organic matter on the bottom of a water body.
Benthos	Organisms living in and on the bottom sediments of lakes and streams. Originally, the term meant the lake bottom, but it is now applied almost uniformly to the animals associated with the lake and stream bottoms.
Best Management Practices (BMPs)	Structural, nonstructural, and managerial techniques that are effective and practical means to control nonpoint source pollutants.
Best Professional Judgment	A conclusion and/or interpretation derived by a trained and/or technically competent individual by applying interpretation and synthesizing information.
Biochemical Oxygen Demand (BOD)	The amount of dissolved oxygen used by organisms during the decomposition (respiration) of organic matter, expressed as mass of oxygen per volume of water, over some specified period of time.
Biological Integrity	1) The condition of an aquatic community inhabiting unimpaired water bodies of a specified habitat as measured by an evaluation of multiple attributes of the aquatic aquatic life (EPA 1996). 2) The ability of an aquatic ecosystem to support and maintain a balanced, integrated, adaptive community of organisms having a species composition, diversity, and functional organization comparable to the natural habitats of a region (Karr 1991).

Biomass	The weight of biological matter. Standing crop is the amount of biomass (e.g., fish or algae) in a body of water at a given time. Often expressed as grams per square meter.
Aquatic life	The animal and plant life of a given region.
Biotic	A term applied to the living components of an area.
Clean Water Act (CWA)	The Federal Water Pollution Control Act (Public Law 92-50, commonly known as the Clean Water Act), as last reauthorized by the Water Quality Act of 1987 (Public Law 100-4), establishes a process for states to use to develop information on, and control the quality of, the nation's water resources.
Coliform Bacteria	A group of bacteria predominantly inhabiting the intestines of humans and animals but also found in soil. Coliform bacteria are commonly used as indicators of the possible presence of pathogenic organisms (also see Fecal Coliform Bacteria).
Colluvium	Material transported to a site by gravity.
Community	A group of interacting organisms living together in a given place.
Conductivity	The ability of an aqueous solution to carry electric current, expressed in micro (µ) mhos/cm at 25 °C. Conductivity is affected by dissolved solids and is used as an indirect measure of total dissolved solids in a water sample.
Cretaceous	The final period of the Mesozoic era (after the Jurassic and before the Tertiary period of the Cenozoic era), thought to have covered the span of time between 135 and 65 million years ago.
Criteria	In the context of water quality, numeric or descriptive factors taken into account in setting standards for various pollutants. These factors are used to determine limits on allowable concentration levels, and to limit the number of violations per year. EPA develops criteria guidance; states establish criteria.

Cubic Feet per Second	A unit of measure for the rate of flow or discharge of water. One cubic foot per second is the rate of flow of a stream with a cross-section of one square foot flowing at a mean velocity of one foot per second. At a steady rate, once cubic foot per second is equal to 448.8 gallons per minute and 10,984 acre-feet per day.
Cultural Eutrophication	The process of eutrophication that has been accelerated by human-caused influences. Usually seen as an increase in nutrient loading (also see Eutrophication).
Culturally Induced Erosion	Erosion caused by increased runoff or wind action due to the work of humans in deforestation, cultivation of the land, overgrazing, and disturbance of natural drainages; the excess of erosion over the normal for an area (also see Erosion).
Debris Torrent	The sudden down slope movement of soil, rock, and vegetation on steep slopes, often caused by saturation from heavy rains.
Decomposition	The breakdown of organic molecules (e.g., sugar) to inorganic molecules (e.g., carbon dioxide and water) through biological and nonbiological processes.
Depth Fines	Percent by weight of particles of small size within a vertical core of volume of a streambed or lake bottom sediment. The upper size threshold for fine sediment for fisheries purposes varies from 0.8 to 6.5 mm depending on the observer and methodology used. The depth sampled varies but is typically about one foot (30 cm).
Designated Uses	Those water uses identified in state water quality standards that must be achieved and maintained as required under the Clean Water Act.
Discharge	The amount of water flowing in the stream channel at the time of measurement. Usually expressed as cubic feet per second (cfs).
Dissolved Oxygen (DO)	The oxygen dissolved in water. Adequate DO is vital to fish and other aquatic life.

Disturbance	Any event or series of events that disrupts ecosystem, community, or population structure and alters the physical environment.
E. coli	Short for *Escherichia Coli, E. coli* are a group of bacteria that are a subspecies of coliform bacteria. Most *E. coli* are essential to the healthy life of all warm-blooded animals, including humans. Their presence is often indicative of fecal contamination.
Ecology	The scientific study of relationships between organisms and their environment; also defined as the study of the structure and function of nature.
Ecological Indicator	A characteristic of an ecosystem that is related to, or derived from, a measure of a biotic or abiotic variable that can provide quantitative information on ecological structure and function. An indicator can contribute to a measure of integrity and sustainability. Ecological indicators are often used within the multimetric index framework.
Ecological Integrity	The condition of an unimpaired ecosystem as measured by combined chemical, physical (including habitat), and biological attributes (EPA 1996).
Ecosystem	The interacting system of a biological community and its non-living (abiotic) environmental surroundings.
Effluent	A discharge of untreated, partially treated, or treated wastewater into a receiving water body.
Endangered Species	Animals, birds, fish, plants, or other living organisms threatened with imminent extinction. Requirements for declaring a species as endangered are contained in the Endangered Species Act.
Environment	The complete range of external conditions, physical and biological, that affect a particular organism or community.
Eocene	An epoch of the early Tertiary period, after the Paleocene and before the Oligocene.

Eolian	Windblown, referring to the process of erosion, transport, and deposition of material by the wind.
Ephemeral Stream	A stream or portion of a stream that flows only in direct response to precipitation. It receives little or no water from springs and no long continued supply from melting snow or other sources. Its channel is at all times above the water table. (American Geologic Institute 1962).
Erosion	The wearing away of areas of the earth's surface by water, wind, ice, and other forces.
Eutrophic	From Greek for "well nourished," this describes a highly productive body of water in which nutrients do not limit algal growth. It is typified by high algal densities and low clarity.
Eutrophication	1) Natural process of maturing (aging) in a body of water. 2) The natural and human-influenced process of enrichment with nutrients, especially nitrogen and phosphorus, leading to an increased production of organic matter.
Exceedance	A violation (according to DEQ policy) of the pollutant levels permitted by water quality criteria.
Existing Beneficial Use or Existing Use	A beneficial use actually attained in waters on or after November 28, 1975, whether or not the use is designated for the waters in Idaho's *Water Quality Standards and Wastewater Treatment Requirements* (IDAPA 58.01.02).
Exotic Species	A species that is not native (indigenous) to a region.
Extrapolation	Estimation of unknown values by extending or projecting from known values.
Fauna	Animal life, especially the animals characteristic of a region, period, or special environment.
Fecal Coliform Bacteria	Bacteria found in the intestinal tracts of all warm-blooded animals or mammals. Their presence in water is an indicator of pollution and possible contamination by pathogens (also see Coliform Bacteria).

Fecal Streptococci	A species of spherical bacteria including pathogenic strains found in the intestines of warm-blooded animals.
Feedback Loop	In the context of watershed management planning, a feedback loop is a process that provides for tracking progress toward goals and revising actions according to that progress.
Fixed-Location Monitoring	Sampling or measuring environmental conditions continuously or repeatedly at the same location.
Flow	See Discharge.
Fluvial	In fisheries, this describes fish whose life history takes place entirely in streams but migrate to smaller streams for spawning.
Focal	Critical areas supporting a mosaic of high quality habitats that sustain a diverse or unusually productive complement of native species.
Fully Supporting	In compliance with water quality standards and within the range of biological reference conditions for all designated and exiting beneficial uses as determined through the *Water Body Assessment Guidance* (Grafe et al. 2000).
Fully Supporting Cold Water	Reliable data indicate functioning, sustainable cold water biological assemblages (e.g., fish, macroinvertebrates, or algae), none of which have been modified significantly beyond the natural range of reference conditions (EPA 1997).
Fully Supporting but Threatened	An intermediate assessment category describing water bodies that fully support beneficial uses, but have a declining trend in water quality conditions, which if not addressed, will lead to a "not fully supporting" status.
Geographical Information Systems (GIS)	A georeferenced database.

Geometric Mean	A back-transformed mean of the logarithmically transformed numbers often used to describe highly variable, right-skewed data (a few large values), such as bacterial data.
Grab Sample	A single sample collected at a particular time and place. It may represent the composition of the water in that water column.
Gradient	The slope of the land, water, or streambed surface.
Ground Water	Water found beneath the soil surface saturating the layer in which it is located. Most ground water originates as rainfall, is free to move under the influence of gravity, and usually emerges again as stream flow.
Growth Rate	A measure of how quickly something living will develop and grow, such as the amount of new plant or animal tissue produced per a given unit of time, or number of individuals added to a population.
Habitat	The living place of an organism or community.
Headwater	The origin or beginning of a stream.
Hydrologic Basin	The area of land drained by a river system, a reach of a river and its tributaries in that reach, a closed basin, or a group of streams forming a drainage area (also see Watershed).
Hydrologic Cycle	The cycling of water from the atmosphere to the earth (precipitation) and back to the atmosphere (evaporation and plant transpiration). Atmospheric moisture, clouds, rainfall, runoff, surface water, ground water, and water infiltrated in soils are all part of the hydrologic cycle.

Hydrologic Unit
One of a nested series of numbered and named watersheds arising from a national standardization of watershed delineation. The initial 1974 effort (USGS 1987) described four levels (region, subregion, accounting unit, cataloging unit) of watersheds throughout the United States. The fourth level is uniquely identified by an eight-digit code built of two-digit fields for each level in the classification. Originally termed a cataloging unit, fourth field hydrologic units have been more commonly called subbasins. Fifth and sixth field hydrologic units have since been delineated for much of the country and are known as watershed and subwatersheds, respectively.

Hydrologic Unit Code (HUC)
The number assigned to a hydrologic unit. Often used to refer to fourth field hydrologic units.

Hydrology
The science dealing with the properties, distribution, and circulation of water.

Impervious
Describes a surface, such as pavement, that water cannot penetrate.

Influent
A tributary stream.

Inorganic
Materials not derived from biological sources.

Instantaneous
A condition or measurement at a moment (instant) in time.

Intergravel Dissolved Oxygen
The concentration of dissolved oxygen within spawning gravel. Consideration for determining spawning gravel includes species, water depth, velocity, and substrate.

Intermittent Stream
1) A stream that flows only part of the year, such as when the ground water table is high or when the stream receives water from springs or from surface sources such as melting snow in mountainous areas. The stream ceases to flow above the streambed when losses from evaporation or seepage exceed the available stream flow. 2) A stream that has a period of zero flow for at least one week during most years.

Interstate Waters	Waters that flow across or form part of state or international boundaries, including boundaries with Indian nations.
Irrigation Return Flow	Surface (and subsurface) water that leaves a field following the application of irrigation water and eventually flows into streams.
Key Watershed	A watershed that has been designated in Idaho Governor Batt's *State of Idaho Bull Trout Conservation Plan* (1996) as critical to the long-term persistence of regionally important trout populations.
Knickpoint	Any interruption or break of slope.
Land Application	A process or activity involving application of wastewater, surface water, or semi-liquid material to the land surface for the purpose of treatment, pollutant removal, or ground water recharge.
Limiting Factor	A chemical or physical condition that determines the growth potential of an organism. This can result in a complete inhibition of growth, but typically results in less than maximum growth rates.
Limnology	The scientific study of fresh water, especially the history, geology, biology, physics, and chemistry of lakes.
Load Allocation (LA)	A portion of a water body's load capacity for a given pollutant that is given to a particular nonpoint source (by class, type, or geographic area).
Load(ing)	The quantity of a substance entering a receiving stream, usually expressed in pounds or kilograms per day or tons per year. Loading is the product of flow (discharge) and concentration.
Loading Capacity (LC)	A determination of how much pollutant a water body can receive over a given period without causing violations of state water quality standards. Upon allocation to various sources, and a margin of safety, it becomes a total maximum daily load.

Loam	Refers to a soil with a texture resulting from a relative balance of sand, silt, and clay. This balance imparts many desirable characteristics for agricultural use.
Loess	A uniform wind-blown deposit of silty material. Silty soils are among the most highly erodible.
Lotic	An aquatic system with flowing water such as a brook, stream, or river where the net flow of water is from the headwaters to the mouth.
Luxury Consumption	A phenomenon in which sufficient nutrients are available in either the sediments or the water column of a water body, such that aquatic plants take up and store an abundance in excess of the plants' current needs.
Macroinvertebrate	An invertebrate animal (without a backbone) large enough to be seen without magnification and retained by a 500µm mesh (U.S. #30) screen.
Macrophytes	Rooted and floating vascular aquatic plants, commonly referred to as water weeds. These plants usually flower and bear seeds. Some forms, such as duckweed and coontail (*Ceratophyllum sp.*), are free-floating forms not rooted in sediment.
Margin of Safety (MOS)	An implicit or explicit portion of a water body's loading capacity set aside to allow the uncertainly about the relationship between the pollutant loads and the quality of the receiving water body. This is a required component of a total maximum daily load (TMDL) and is often incorporated into conservative assumptions used to develop the TMDL (generally within the calculations and/or models). The MOS is not allocated to any sources of pollution.
Mass Wasting	A general term for the down slope movement of soil and rock material under the direct influence of gravity.
Mean	Describes the central tendency of a set of numbers. The arithmetic mean (calculated by adding all items in a list, then dividing by the number of items) is the statistic most familiar to most people.

Median	The middle number in a sequence of numbers. If there are an even number of numbers, the median is the average of the two middle numbers. For example, 4 is the median of 1, 2, 4, 14, 16; and 6 is the median of 1, 2, 5, 7, 9, 11.
Metric	1) A discrete measure of something, such as an ecological indicator (e.g., number of distinct taxon). 2) The metric system of measurement.
Milligrams per Liter (mg/l)	A unit of measure for concentration in water, essentially equivalent to parts per million (ppm).
Million gallons per day (MGD)	A unit of measure for the rate of discharge of water, often used to measure flow at wastewater treatment plants. One MGD is equal to 1.547 cubic feet per second.
Miocene	Of, relating to, or being an epoch of, the Tertiary between the Pliocene and the Oligocene periods, or the corresponding system of rocks.
Monitoring	A periodic or continuous measurement of the properties or conditions of some medium of interest, such as monitoring a water body.
Mouth	The location where flowing water enters into a larger water body.
National Pollution Discharge Elimination System (NPDES)	A national program established by the Clean Water Act for permitting point sources of pollution. Discharge of pollution from point sources is not allowed without a permit.
Natural Condition	A condition indistinguishable from that without human-caused disruptions.
Nitrogen	An element essential to plant growth, and thus is considered a nutrient.
Nodal	Areas that are separated from focal and adjunct habitats, but serve critical life history functions for individual native fish.

Nonpoint Source	A dispersed source of pollutants, generated from a geographical area when pollutants are dissolved or suspended in runoff and then delivered into waters of the state. Nonpoint sources are without a discernable point or origin. They include, but are not limited to, irrigated and non-irrigated lands used for grazing, crop production, and silviculture; rural roads; construction and mining sites; log storage or rafting; and recreation sites.
Not Assessed (NA)	A concept and an assessment category describing water bodies that have been studied, but are missing critical information needed to complete an assessment.
Not Attainable	A concept and an assessment category describing water bodies that demonstrate characteristics that make it unlikely that a beneficial use can be attained (e.g., a stream that is dry but designated for salmonid spawning).
Not Fully Supporting	Not in compliance with water quality standards or not within the range of biological reference conditions for any beneficial use as determined through the *Water Body Assessment Guidance* (Grafe et al. 2000).
Not Fully Supporting Cold Water	At least one biological assemblage has been significantly modified beyond the natural range of its reference condition (EPA 1997).
Nuisance	Anything which is injurious to the public health or an obstruction to the free use, in the customary manner, of any waters of the state.
Nutrient	Any substance required by living things to grow. An element or its chemical forms essential to life, such as carbon, oxygen, nitrogen, and phosphorus. Commonly refers to those elements in short supply, such as nitrogen and phosphorus, which usually limit growth.
Nutrient Cycling	The flow of nutrients from one component of an ecosystem to another, as when macrophytes die and release nutrients that become available to algae (organic to inorganic phase and return).

Oligotrophic	The Greek term for "poorly nourished." This describes a body of water in which productivity is low and nutrients are limiting to algal growth, as typified by low algal density and high clarity.
Organic Matter	Compounds manufactured by plants and animals that contain principally carbon.
Orthophosphate	A form of soluble inorganic phosphorus most readily used for algal growth.
Oxygen-Demanding Materials	Those materials, mainly organic matter, in a water body which consume oxygen during decomposition.
Parameter	A variable, measurable property whose value is a determinant of the characteristics of a system; e.g., temperature, dissolved oxygen, and fish populations are parameters of a stream or lake.
Partitioning	The sharing of limited resources by different races or species; use of different parts of the habitat, or the same habitat at different times. Also the separation of a chemical into two or more phases, such as partitioning of phosphorus between the water column and sediment.
Pathogens	Disease-producing organisms (e.g., bacteria, viruses, parasites).
Perennial Stream	A stream that flows year-around in most years.
Periphyton	Attached microflora (algae and diatoms) growing on the bottom of a water body or on submerged substrates, including larger plants.
Pesticide	Substances or mixtures of substances intended for preventing, destroying, repelling, or mitigating any pest. Also, any substance or mixture intended for use as a plant regulator, defoliant, or desiccant.
pH	The negative $\log_{10}$ of the concentration of hydrogen ions, a measure which in water ranges from very acid (pH=1) to very alkaline (pH=14). A pH of 7 is neutral. Surface waters usually measure between pH 6 and 9.

Phased TMDL A total maximum daily load (TMDL) that identifies interim load allocations and details further monitoring to gauge the success of management actions in achieving load reduction goals and the effect of actual load reductions on the water quality of a water body. Under a phased TMDL, a refinement of load allocations, waste load allocations, and the margin of safety is planned at the outset.

Phosphorus An element essential to plant growth, often in limited supply, and thus considered a nutrient.

Physiochemical In the context of bioassessment, the term is commonly used to mean the physical and chemical factors of the water column that relate to aquatic aquatic life. Examples in bioassessment usage include saturation of dissolved gases, temperature, pH, conductivity, dissolved or suspended solids, forms of nitrogen, and phosphorus. This term is used interchangeable with the terms "physical/chemical" and "physicochemical."

Plankton Microscopic algae (phytoplankton) and animals (zooplankton) that float freely in open water of lakes and oceans.

Point Source A source of pollutants characterized by having a discrete conveyance, such as a pipe, ditch, or other identifiable "point" of discharge into a receiving water. Common point sources of pollution are industrial and municipal wastewater.

Pollutant Generally, any substance introduced into the environment that adversely affects the usefulness of a resource or the health of humans, animals, or ecosystems.

Pollution A very broad concept that encompasses human-caused changes in the environment which alter the functioning of natural processes and produce undesirable environmental and health effects. This includes human-induced alteration of the physical, biological, chemical, and radiological integrity of water and other media.

Population — A group of interbreeding organisms occupying a particular space; the number of humans or other living creatures in a designated area.

Pretreatment — The reduction in the amount of pollutants, elimination of certain pollutants, or alteration of the nature of pollutant properties in wastewater prior to, or in lieu of, discharging or otherwise introducing such wastewater into a publicly owned wastewater treatment plant.

Primary Productivity — The rate at which algae and macrophytes fix carbon dioxide using light energy. Commonly measured as milligrams of carbon per square meter per hour.

Protocol — A series of formal steps for conducting a test or survey.

Qualitative — Descriptive of kind, type, or direction.

Quality Assurance (QA) — A program organized and designed to provide accurate and precise results. Included are the selection of proper technical methods, tests, or laboratory procedures; sample collection and preservation; the selection of limits; data evaluation; quality control; and personnel qualifications and training. The goal of QA is to assure the data provided are of the quality needed and claimed (Rand 1995, EPA 1996).

Quality Control (QC) — Routine application of specific actions required to provide information for the quality assurance program. Included are standardization, calibration, and replicate samples. QC is implemented at the field or bench level (Rand 1995, EPA 1996).

Quantitative — Descriptive of size, magnitude, or degree.

Reach — A stream section with fairly homogenous physical characteristics.

Reconnaissance — An exploratory or preliminary survey of an area.

Reference — A physical or chemical quantity whose value is known, and thus is used to calibrate or standardize instruments.

Reference Condition	1) A condition that fully supports applicable beneficial uses with little affect from human activity and represents the highest level of support attainable. 2) A benchmark for populations of aquatic ecosystems used to describe desired conditions in a biological assessment and acceptable or unacceptable departures from them. The reference condition can be determined through examining regional reference sites, historical conditions, quantitative models, and expert judgment (Hughes 1995).
Reference Site	A specific locality on a water body that is minimally impaired and is representative of reference conditions for similar water bodies.
Representative Sample	A portion of material or water that is as similar in content and consistency as possible to that in the larger body of material or water being sampled.
Resident	A term that describes fish that do not migrate.
Respiration	A process by which organic matter is oxidized by organisms, including plants, animals, and bacteria. The process converts organic matter to energy, carbon dioxide, water, and lesser constituents.
Riffle	A relatively shallow, gravelly area of a streambed with a locally fast current, recognized by surface choppiness. Also an area of higher streambed gradient and roughness.
Riparian	Associated with aquatic (stream, river, lake) habitats. Living or located on the bank of a water body.
Riparian Habitat Conservation Area (RHCA)	A U.S. Forest Service description of land within the following number of feet up-slope of each of the banks of streams: - 300 feet from perennial fish-bearing streams - 150 feet from perennial non-fish-bearing streams - 100 feet from intermittent streams, wetlands, and ponds in priority watersheds.
River	A large, natural, or human-modified stream that flows in a defined course or channel, or a series of diverging and converging channels.

Runoff	The portion of rainfall, melted snow, or irrigation water that flows across the surface, through shallow underground zones (interflow), and through ground water to creates streams.
Sediments	Deposits of fragmented materials from weathered rocks and organic material that were suspended in, transported by, and eventually deposited by water or air.
Settleable Solids	The volume of material that settles out of one liter of water in one hour.
Species	1) A reproductively isolated aggregate of interbreeding organisms having common attributes and usually designated by a common name. 2) An organism belonging to such a category.
Spring	Ground water seeping out of the earth where the water table intersects the ground surface.
Stagnation	The absence of mixing in a water body.
Stenothermal	Unable to tolerate a wide temperature range.
Stratification	An Idaho Department of Environmental Quality classification method used to characterize comparable units (also called classes or strata).
Stream	A natural water course containing flowing water, at least part of the year. Together with dissolved and suspended materials, a stream normally supports communities of plants and animals within the channel and the riparian vegetation zone.
Stream Order	Hierarchical ordering of streams based on the degree of branching. A first-order stream is an unforked or unbranched stream. Under Strahler's (1957) system, higher order streams result from the joining of two streams of the same order.
Storm Water Runoff	Rainfall that quickly runs off the land after a storm. In developed watersheds the water flows off roofs and pavement into storm drains that may feed quickly and directly into the stream. The water often carries pollutants picked up from these surfaces.

Stressors	Physical, chemical, or biological entities that can induce adverse effects on ecosystems or human health.
Subbasin	A large watershed of several hundred thousand acres. This is the name commonly given to 4th field hydrologic units (also see Hydrologic Unit).
Subbasin Assessment (SBA)	A watershed-based problem assessment that is the first step in developing a total maximum daily load in Idaho.
Subwatershed	A smaller watershed area delineated within a larger watershed, often for purposes of describing and managing localized conditions. Also proposed for adoption as the formal name for 6th field hydrologic units.
Surface Fines	Sediments of small size deposited on the surface of a streambed or lake bottom. The upper size threshold for fine sediment for fisheries purposes varies from 0.8 to 605 mm depending on the observer and methodology used. Results are typically expressed as a percentage of observation points with fine sediment.
Surface Runoff	Precipitation, snow melt, or irrigation water in excess of what can infiltrate the soil surface and be stored in small surface depressions; a major transporter of nonpoint source pollutants in rivers, streams, and lakes. Surface runoff is also called overland flow.
Surface Water	All water naturally open to the atmosphere (rivers, lakes, reservoirs, streams, impoundments, seas, estuaries, etc.) and all springs, wells, or other collectors that are directly influenced by surface water.
Suspended Sediments	Fine material (usually sand size or smaller) that remains suspended by turbulence in the water column until deposited in areas of weaker current. These sediments cause turbidity and, when deposited, reduce living space within streambed gravels and can cover fish eggs or alevins.

Taxon	Any formal taxonomic unit or category of organisms (e.g., species, genus, family, order). The plural of taxon is taxa (Armantrout 1998).
Tertiary	An interval of geologic time lasting from 66.4 to 1.6 million years ago. It constitutes the first of two periods of the Cenozoic Era, the second being the Quaternary. The Tertiary has five subdivisions, which from oldest to youngest are the Paleocene, Eocene, Oligocene, Miocene, and Pliocene epochs.
Thalweg	The center of a stream's current, where most of the water flows.
Threatened Species	Species, determined by the U.S. Fish and Wildlife Service, which are likely to become endangered within the foreseeable future throughout all or a significant portion of their range.
Total Maximum Daily Load (TMDL)	A TMDL is a water body's loading capacity after it has been allocated among pollutant sources. It can be expressed on a time basis other than daily if appropriate. Sediment loads, for example, are often calculated on an annual bases. TMDL = Loading Capacity = Load Allocation + Waste Load Allocation + Margin of Safety. In common usage, a TMDL also refers to the written document that contains the statement of loads and supporting analyses, often incorporating TMDLs for several water bodies and/or pollutants within a given watershed.
Total Dissolved Solids	Dry weight of all material in solution in a water sample as determined by evaporating and drying filtrate.
Total Suspended Solids (TSS)	The dry weight of material retained on a filter after filtration. Filter pore size and drying temperature can vary. American Public Health Association Standard Methods (Greenborg, Clescevi, and Eaton 1995) call for using a filter of 2.0 micron or smaller; a 0.45 micron filter is also often used. This method calls for drying at a temperature of 103-105 °C.

Toxic Pollutants	Materials that cause death, disease, or birth defects in organisms that ingest or absorb them. The quantities and exposures necessary to cause these effects can vary widely.
Tributary	A stream feeding into a larger stream or lake.
Trophic State	The level of growth or productivity of a lake as measured by phosphorus content, chlorophyll *a* concentrations, amount (biomass) of aquatic vegetation, algal abundance, and water clarity.
Turbidity	A measure of the extent to which light passing through water is scattered by fine suspended materials. The effect of turbidity depends on the size of the particles (the finer the particles, the greater the effect per unit weight) and the color of the particles.
Vadose Zone	The unsaturated region from the soil surface to the ground water table.
Waste Load Allocation (WLA)	The portion of receiving water's loading capacity that is allocated to one of its existing or future point sources of pollution. Waste load allocations specify how much pollutant each point source may release to a water body.
Water Body	A stream, river, lake, estuary, coastline, or other water feature, or portion thereof.
Water Column	Water between the interface with the air at the surface and the interface with the sediment layer at the bottom. The idea derives from a vertical series of measurements (oxygen, temperature, phosphorus) used to characterize water.
Water Pollution	Any alteration of the physical, thermal, chemical, biological, or radioactive properties of any waters of the state, or the discharge of any pollutant into the waters of the state, which will or is likely to create a nuisance or to render such waters harmful, detrimental, or injurious to public health, safety, or welfare; to fish and wildlife; or to domestic, commercial, industrial, recreational, aesthetic, or other beneficial uses.

Water Quality	A term used to describe the biological, chemical, and physical characteristics of water with respect to its suitability for a beneficial use.
Water Quality Criteria	Levels of water quality expected to render a body of water suitable for its designated uses. Criteria are based on specific levels of pollutants that would make the water harmful if used for drinking, swimming, farming, or industrial processes.
Water Quality Limited	A label that describes water bodies for which one or more water quality criterion is not met or beneficial uses are not fully supported. Water quality limited segments may or may not be on a 303(d) list.
Water Quality Limited Segment (WQLS)	Any segment placed on a state's 303(d) list for failure to meet applicable water quality standards, and/or is not expected to meet applicable water quality standards in the period prior to the next list. These segments are also referred to as "303(d) listed."
Water Quality Management Plan	A state or area-wide waste treatment management plan developed and updated in accordance with the provisions of the Clean Water Act.
Water Quality Modeling	The prediction of the response of some characteristics of lake or stream water based on mathematical relations of input variables such as climate, stream flow, and inflow water quality.
Water Quality Standards	State-adopted and EPA-approved ambient standards for water bodies. The standards prescribe the use of the water body and establish the water quality criteria that must be met to protect designated uses.
Water Table	The upper surface of ground water; below this point, the soil is saturated with water.
Watershed	1) All the land which contributes runoff to a common point in a drainage network, or to a lake outlet. Watersheds are infinitely nested, and any large watershed is composed of smaller "subwatersheds." 2) The whole geographic region which contributes water to a point of interest in a water body.

Water Body Identification Number (WBID)	A number that uniquely identifies a water body in Idaho ties in to the Idaho Water Quality Standards and GIS information.
Wetland	An area that is at least some of the time saturated by surface or ground water so as to support with vegetation adapted to saturated soil conditions. Examples include swamps, bogs, fens, and marshes.
Young of the Year	Young fish born the year captured, evidence of spawning activity.

Appendix A. Metric – English Unit Conversion Chart

	English Units	Metric Units	To Convert	Example
Distance	Miles (mi)	Kilometers (km)	1 mi = 1.61 km 1 km = 0.62 mi	3 mi = 4.83 km 3 km = 1.86 mi
Length	Inches (in) Feet (ft)	Centimeters (cm) Meters (m)	1 in = 2.54 cm 1 cm = 0.39 in 1 ft = 0.30 m 1 m = 3.28 ft	3 in = 7.62 cm 3 cm = 1.18 in 3 ft = 0.91 m 3 m = 9.84 ft
Area	Acres (ac) Square Feet (ft^2) Square Miles (mi^2)	Hectares (ha) Square Meters (m^2) Square Kilometers (km^2)	1 ac = 0.40 ha 1 ha = 2.47 ac 1 ft^2 = 0.09 m^2 1 m^2 = 10.76 ft^2 1 mi^2 = 2.59 km^2 1 km^2 = 0.39 mi^2	3 ac = 1.20 ha 3 ha = 7.41 ac 3 ft^2 = 0.28 m^2 3 m^2 = 32.29 ft^2 3 mi^2 = 7.77 km^2 3 km^2 = 1.16 mi^2
Volume	Gallons (g) Cubic Feet (ft^3)	Liters (l) Cubic Meters (m^3)	1 g = 3.78 l 1 l = 0.26 g 1 ft^3 = 0.03 m^3 1 m^3 = 35.32 ft^3	3 g = 11.35 l 3 l = 0.79 g 3 ft^3 = 0.09 m^3 3 m^3 = 105.94 ft^3
Flow Rate	Cubic Feet per Second (ft^3/sec)[1]	Cubic Meters per Second (m^3/sec)	1 ft^3/sec = 0.03 m^3/sec 1 m^3/sec = ft^3/sec	3 ft^3/sec = 0.09 m^3/sec 3 m^3/sec = 105.94 ft^3/sec
Concentration	Parts per Million (ppm)	Milligrams per Liter (mg/l)	1 ppm = 1 mg/l[2]	3 ppm = 3 mg/l
Weight	Pounds (lbs)	Kilograms (kg)	1 lb = 0.45 kg 1 kg = 2.20 lbs	3 lb = 1.36 kg 3 kg = 6.61 kg
Temperature	Fahrenheit (°F)	Celsius (°C)	°C = 0.55 (F - 32) °F = (C x 1.8) + 32	3 °F = -15.95 °C 3 ° C = 37.4 °F

[1] 1 ft^3/sec = 0.65 million gallons per day; 1 million gallons per day is equal to 1.55 ft^3/sec.

[2] **The ratio of 1 ppm = 1 mg/l is approximate and is only accurate for water.**

Appendix B. Water Body Identification Numbers

Table 1. Water Body Identification Numbers and their boundaries

Water Body	WBID No.	Boundaries
Mud Lake	1	
Medicine Lodge Creek	2	Indian Creek to Sinks
Indian Creek	3	Forks to Medicine Lodge Creek
Indian Creek, E. Fk.	4	Headwaters to Forks
Indian Creek, W. Fk.	5	Headwaters to Forks
Medicine Lodge Creek	6	Confluence of Edie Creek and Medicine Lodge Creek to confluence with Indian Creek
Middle Creek	7	Confluence of Dry Creek and Middle Creek to Medicine Lodge Creek
Water Body	**WBID No.**	**Boundaries**
Middle Creek	8	Headwaters to Dry Creek confluence
Dry Creek	9	Headwaters to Middle Creek
Edie Creek	10	Headwaters to Medicine Lodge Creek
Medicine Lodge Creek	11	Confluence of Warm Creek and Webber Creek to Confluence with Edie Creek
Irving Creek	12	Headwaters to Medicine Lodge Creek
Warm Creek	13	Headwaters to Confluence with Warm Creek
Divide Creek	14	Headwaters to Warm Creek
Horse Creek	15	Headwaters to Warm Creek
Fritz Creek	16	Headwaters to Medicine Lodge Creek
Webber Creek	17	Headwaters to Medicine Lodge Creek
Deep Creek	18	Headwaters to sinks
Blue Creek	19	Headwaters to sinks
Warm Springs Creek	20	Headwaters to sinks
Crooked Creek	21	Headwaters to sinks
Chandler Canyon	22	Headwaters to sinks

Appendix C. Depth Fines Data

Cumulative depth fines percentage composition for streams sampled within the Medicine Lodge Subbasin.

Figure 1. Crooked Creek Depth Fines for 2000, Lower Section

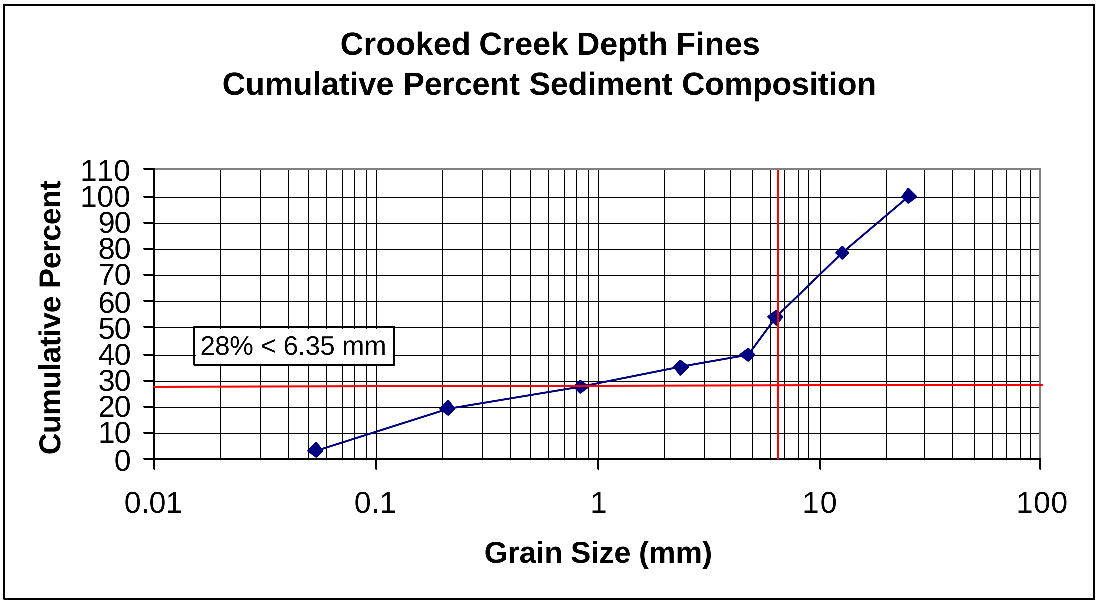


Figure 2. Deep Creek Depth Fines for 2000, Mid-section at Road Crossing

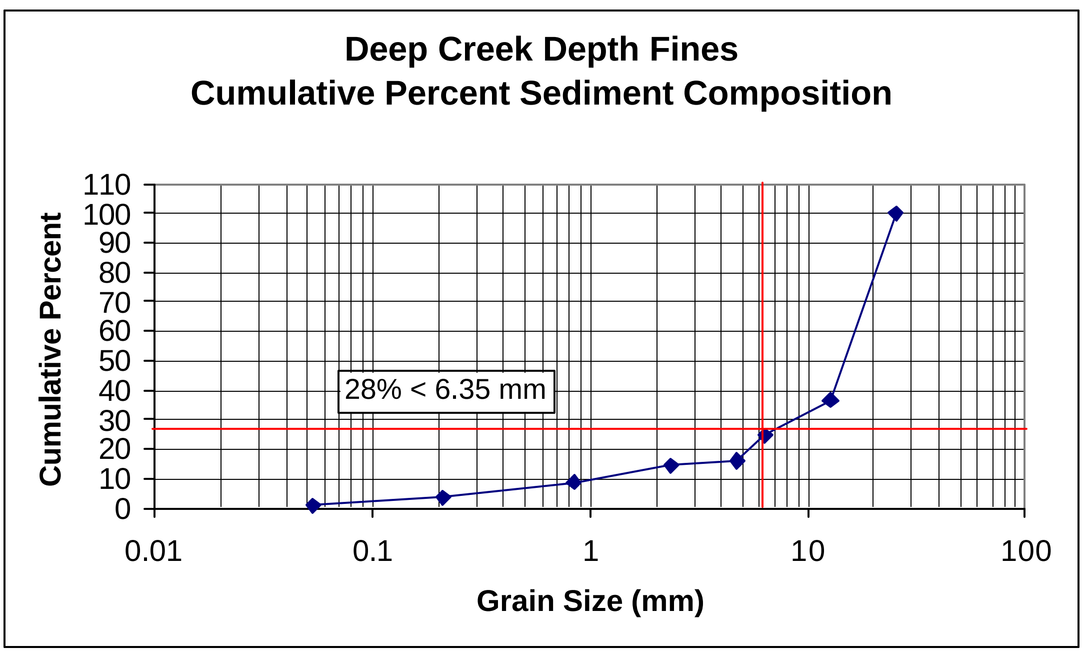


Figure 3. Edie Creek Depth Fines for 2000, Just Past BLM Boundary

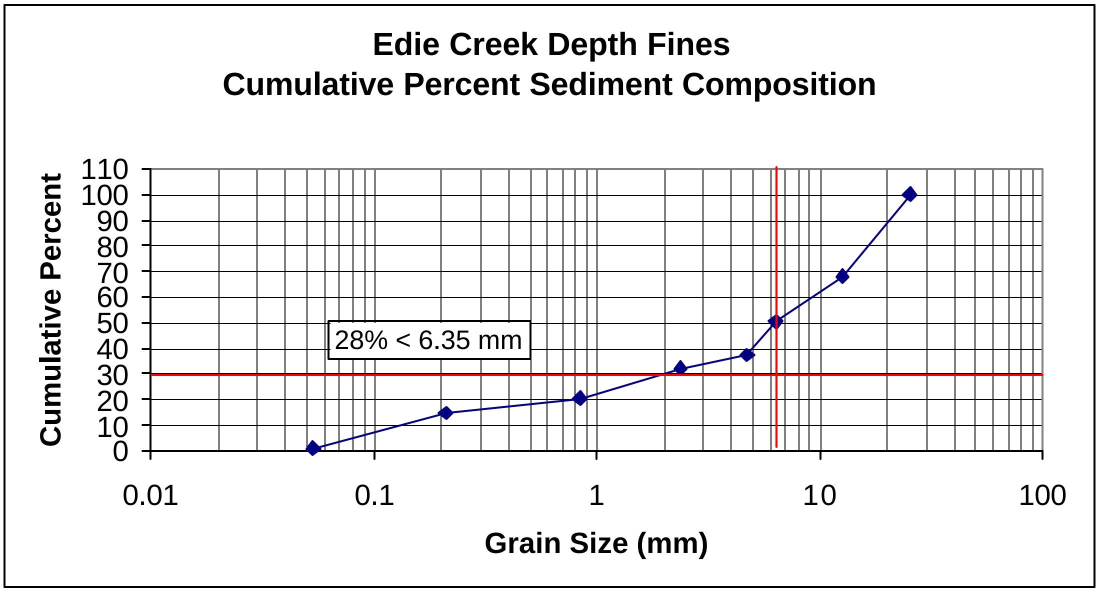


Figure 4. Fritz Creek Depth Fines for 2000, Just Below Forks

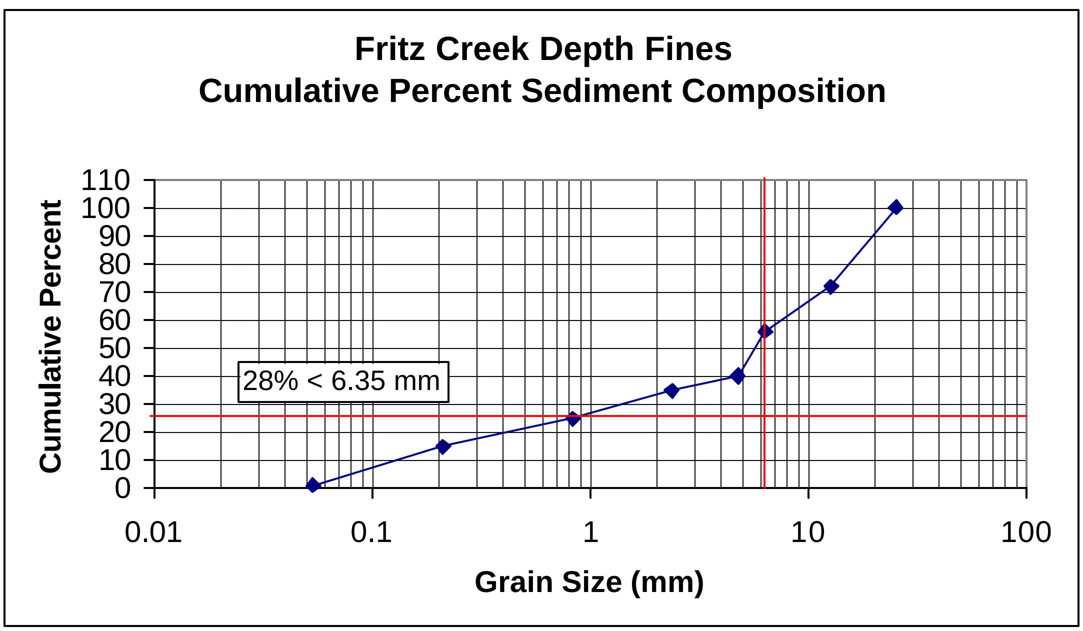


Figure 5. Irving Creek Depth Fines for 2000, Below Forks

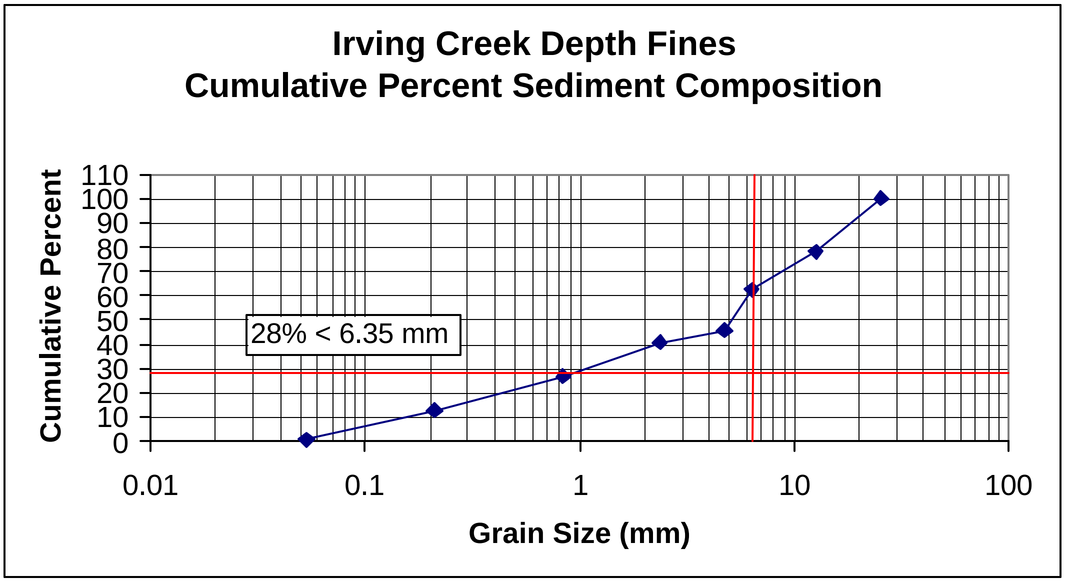


Figure 6. Medicine Lodge Creek Depth Fines for 2000, at Small, Idaho

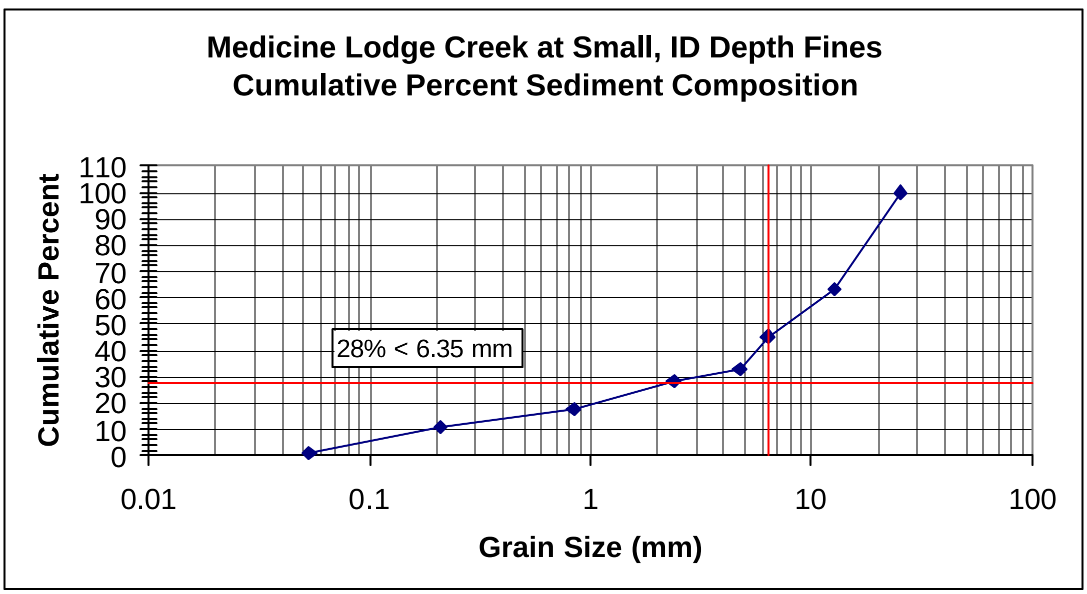


Figure 7. Medicine Lodge Creek Depth Fines for 2000, Mid-section

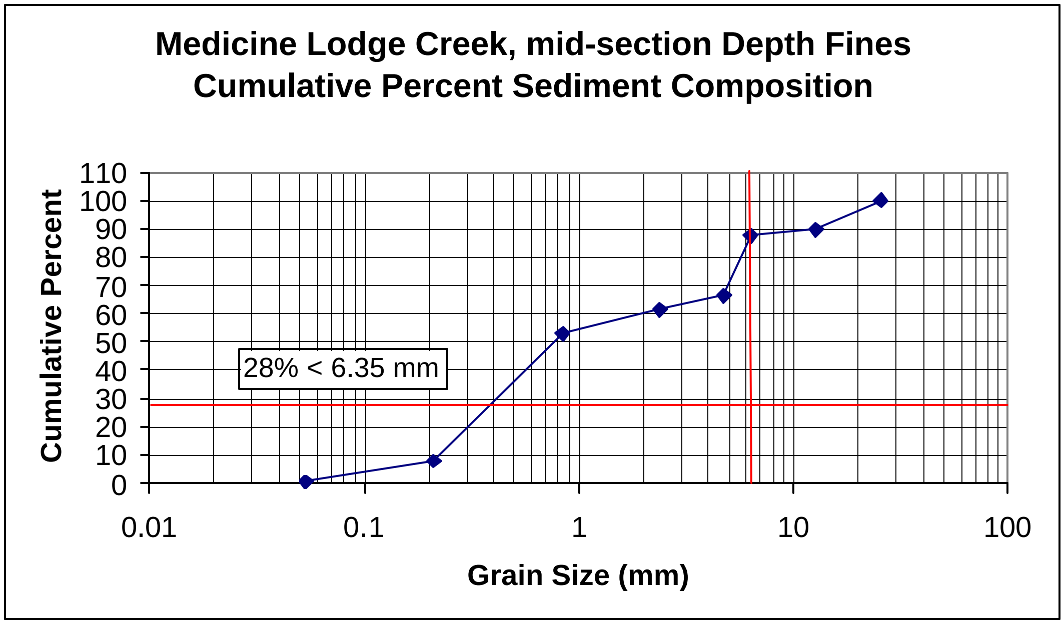


Figure 8. Middle Creek Depth Fines for 2000, Lower Section

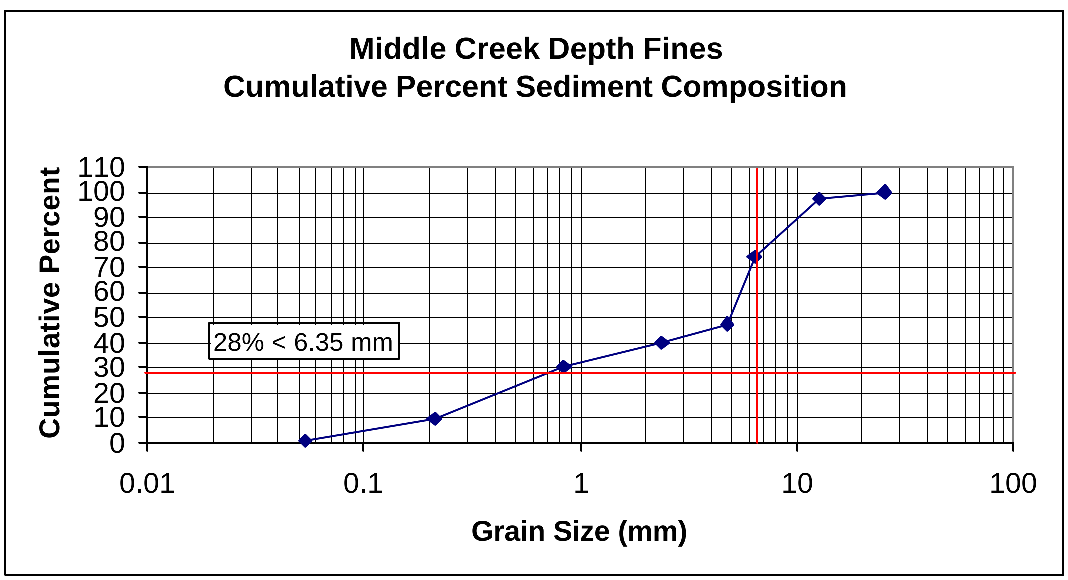


Figure 9. Warm Springs Creek Depth Fines for 2000, Road Crossing at Maud Mountain

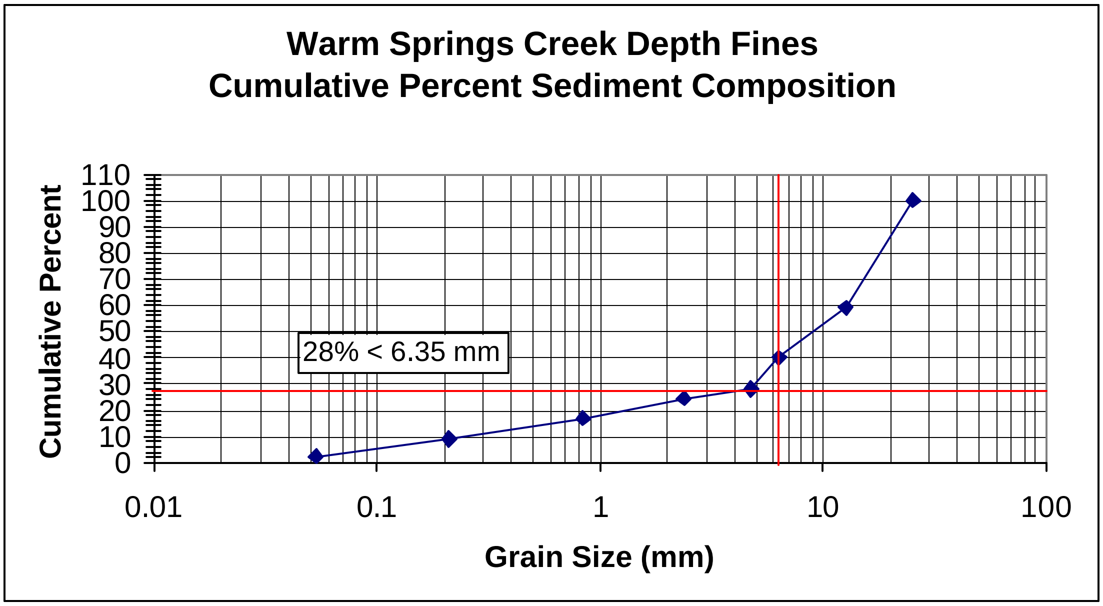


Figure 10. Webber Creek Depth Fines for 2000, Just Past USFS Boundary

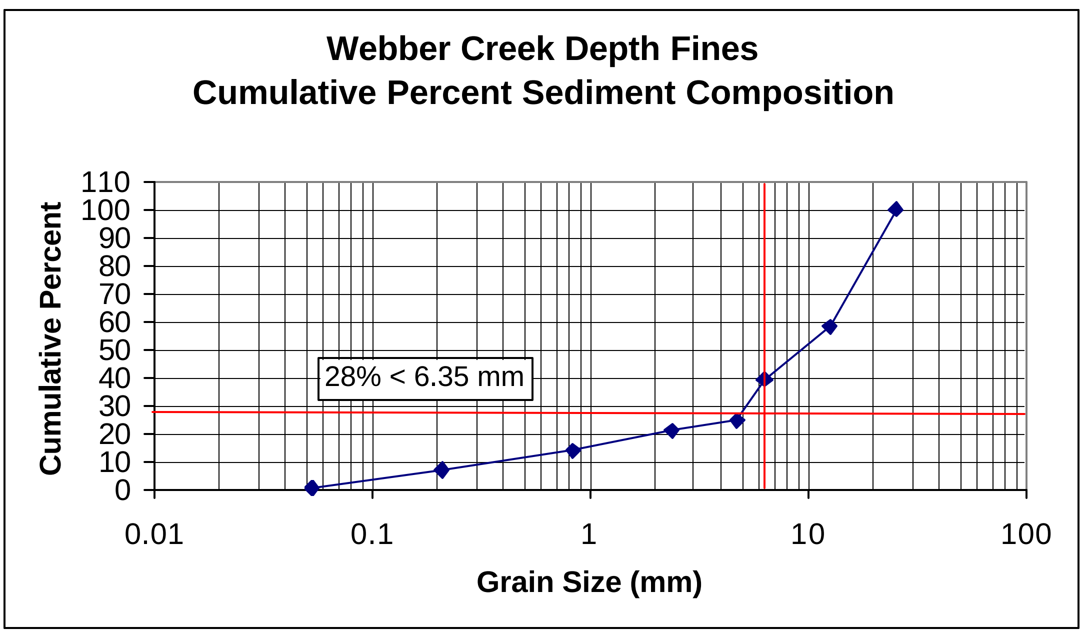


Figure 11. Edie Creek Depth Fines for 2001, 1.1 mi. up Edie Creek Road

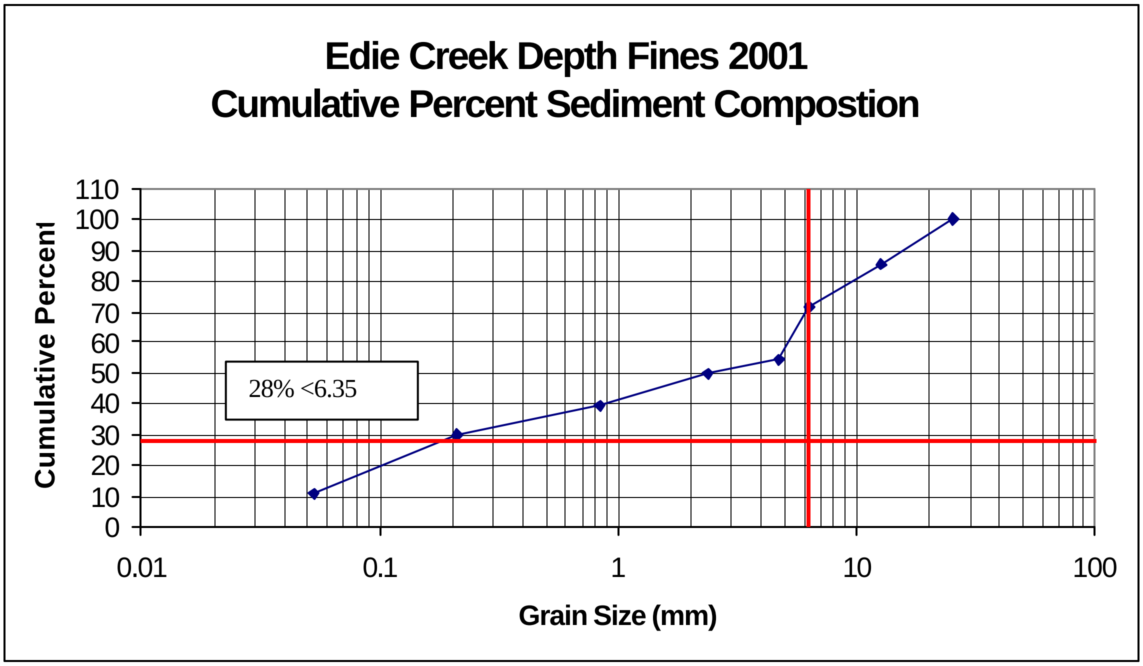


Figure 12. Edie Creek Depth Fines for 2001, Just Past BLM Boundary

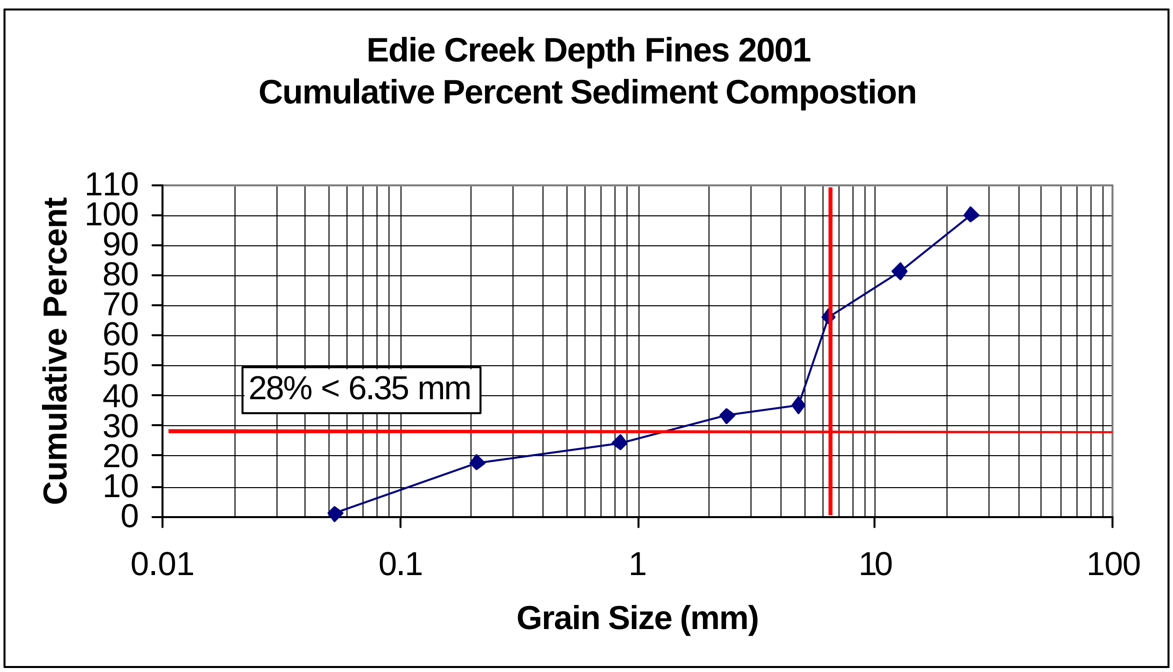


Figure 13. Irving Creek Depth Fines for 2001, Mouth

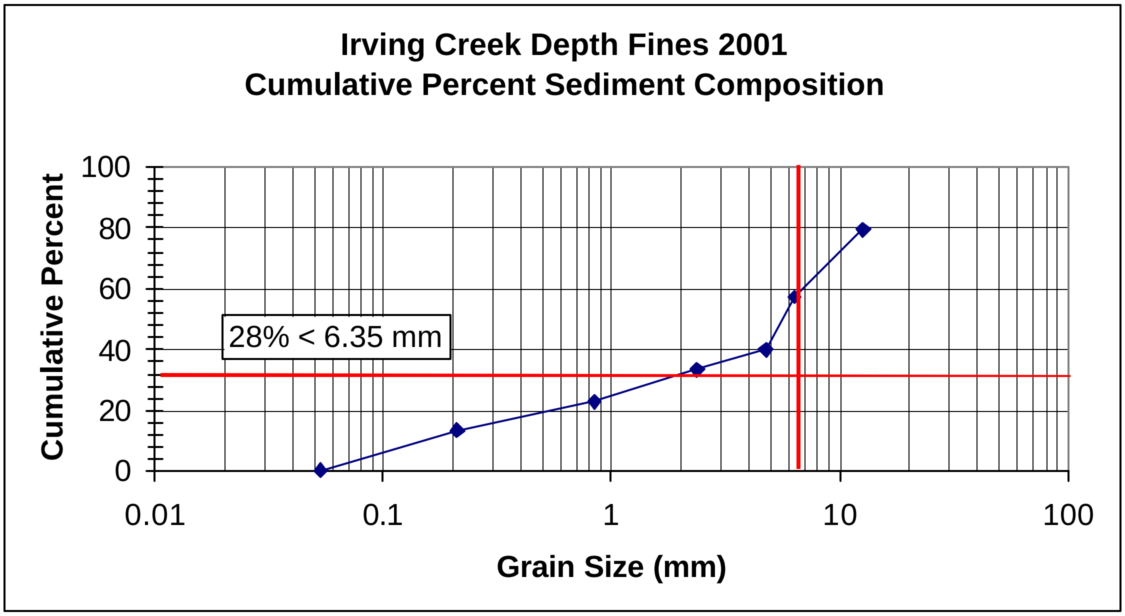


Figure 14. Irving Creek Depth Fines for 2001, East Fork on BLM

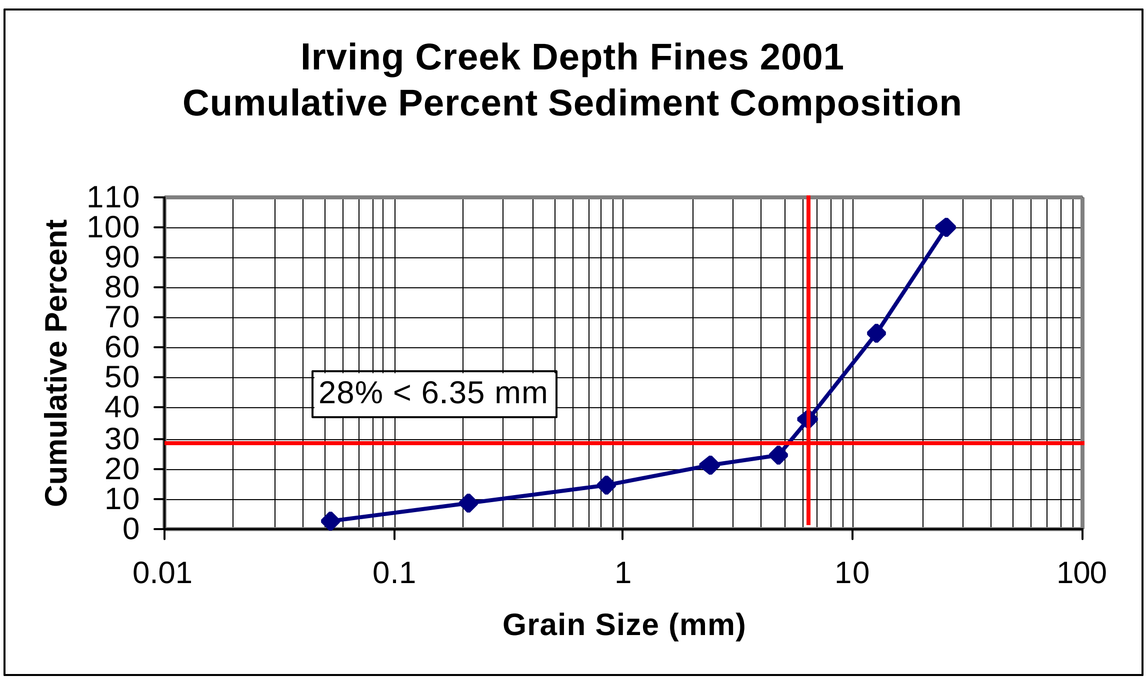


Figure 15. Irving Creek Depth Fines for 2001, Just Past BLM Boundary

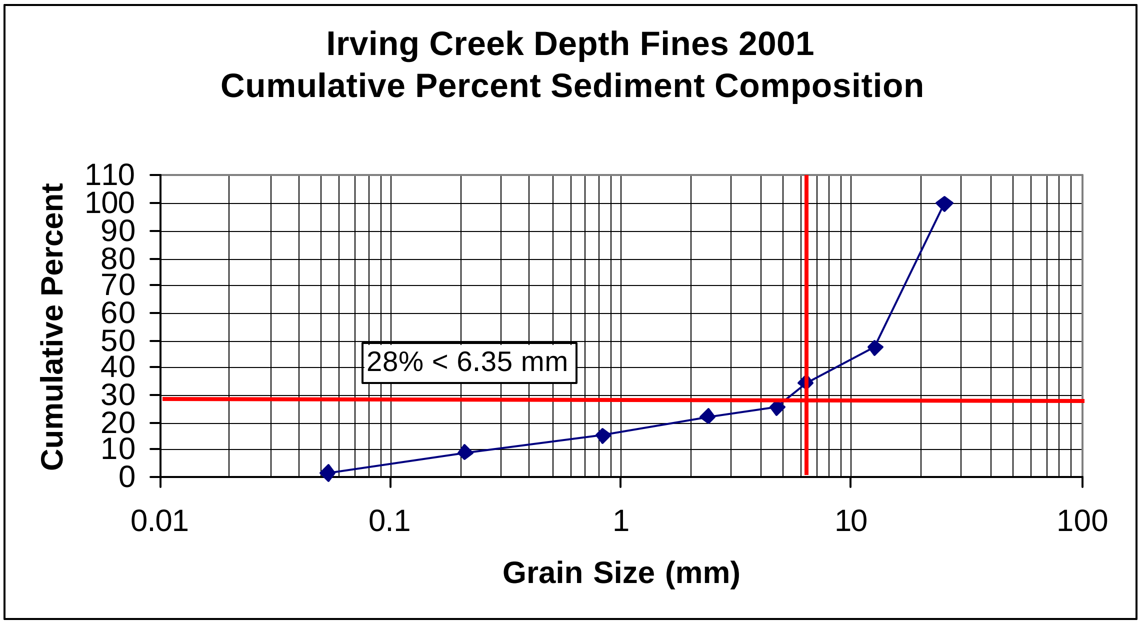


Figure 16. Irving Creek Depth Fines for 2001, High on USFS Land

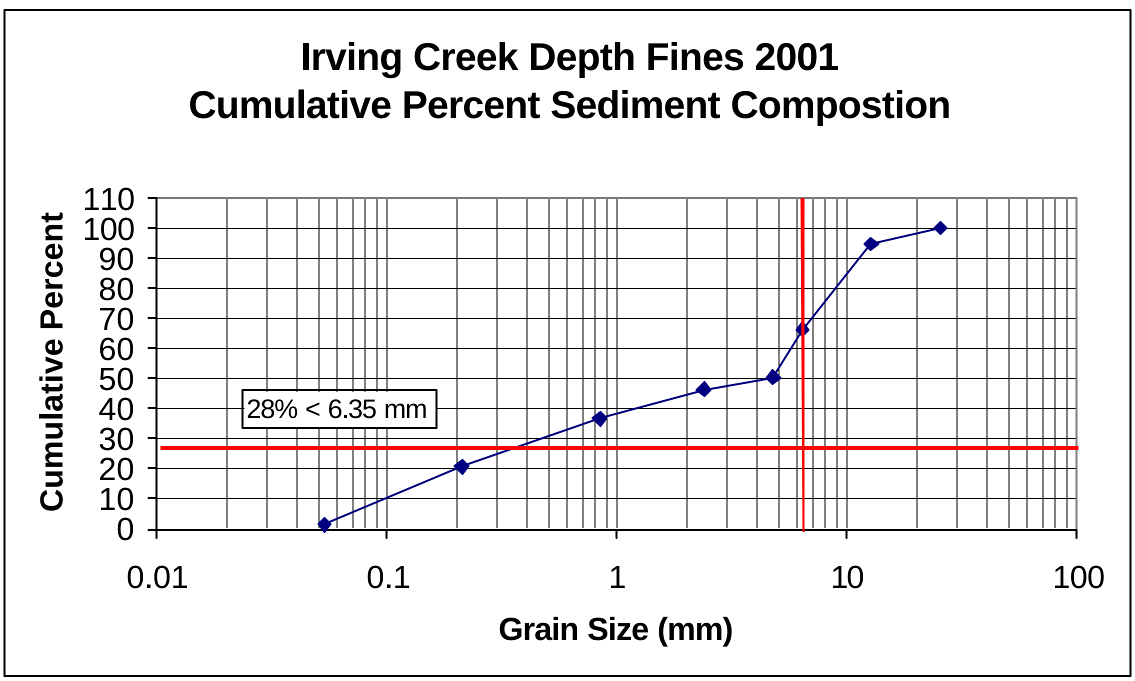


Figure 17. Middle Creek Depth Fines for 2001, High on USFS Land

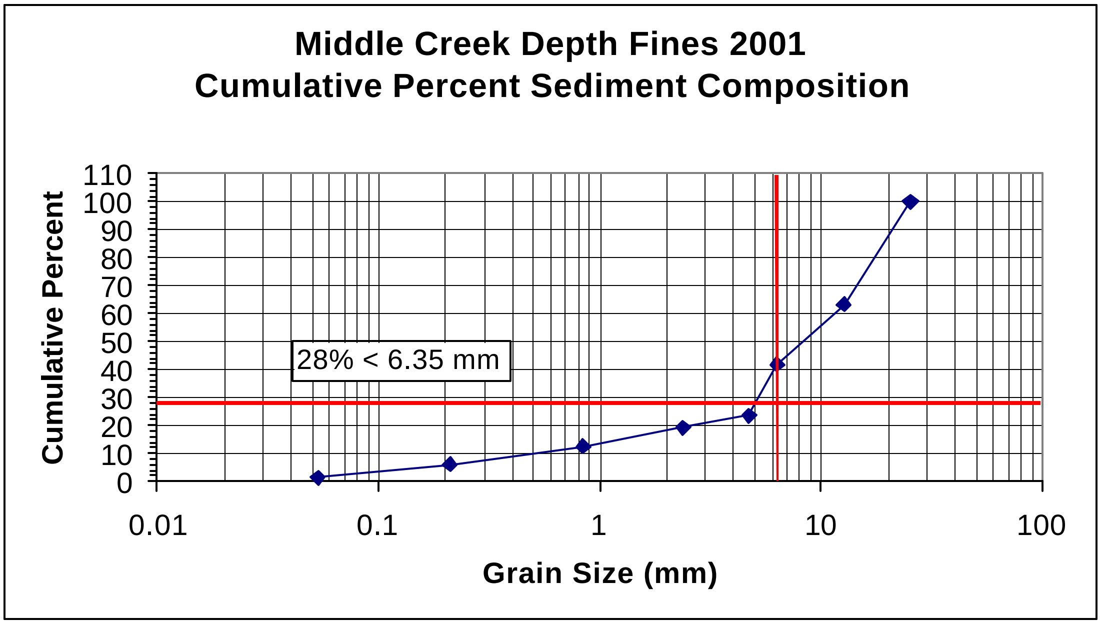


Figure 18. Warm Creek Depth Fines for 2001, Just Above Horse Creek

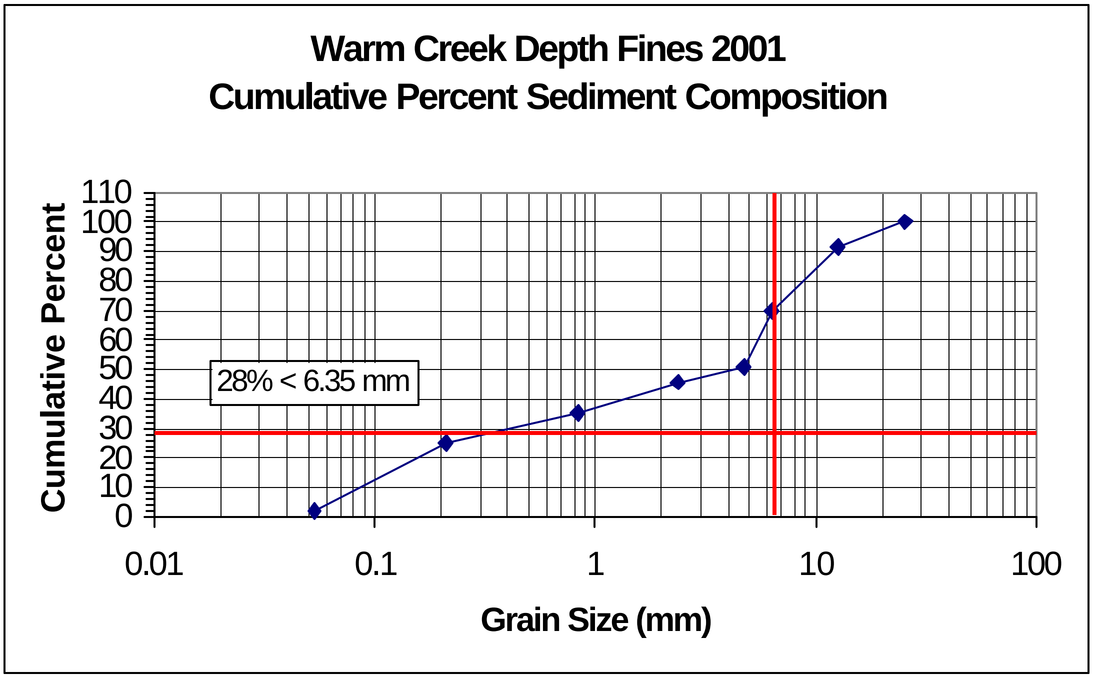


Figure 19. Webber Creek Depth Fines for 2001, At Bridge

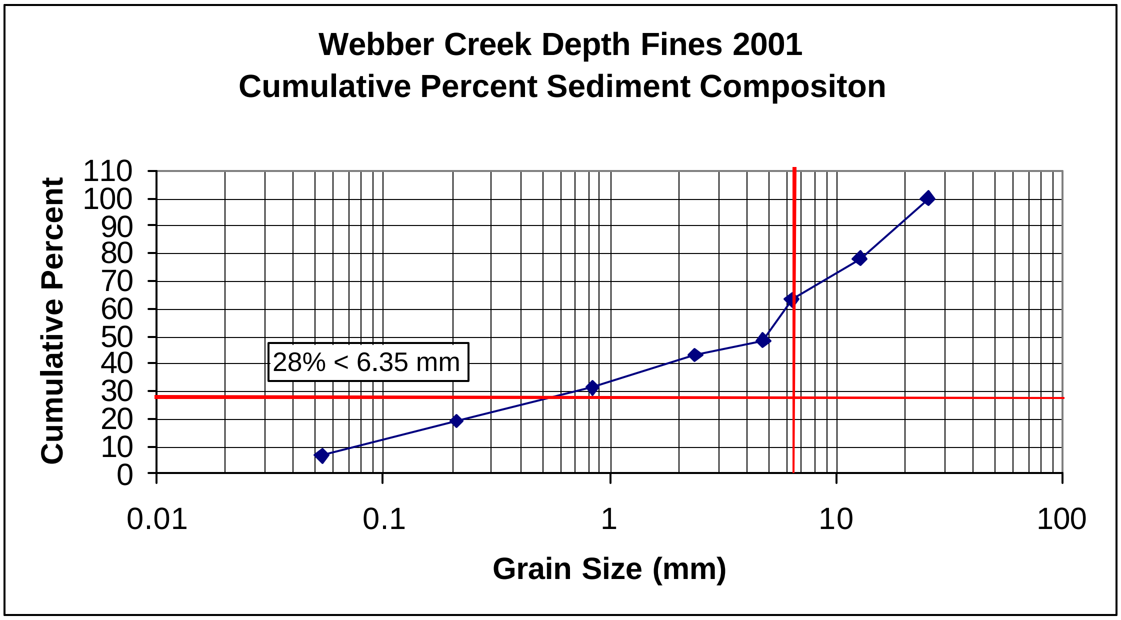


Figure 20. Webber Creek Depth Fines for 2001, At Campground

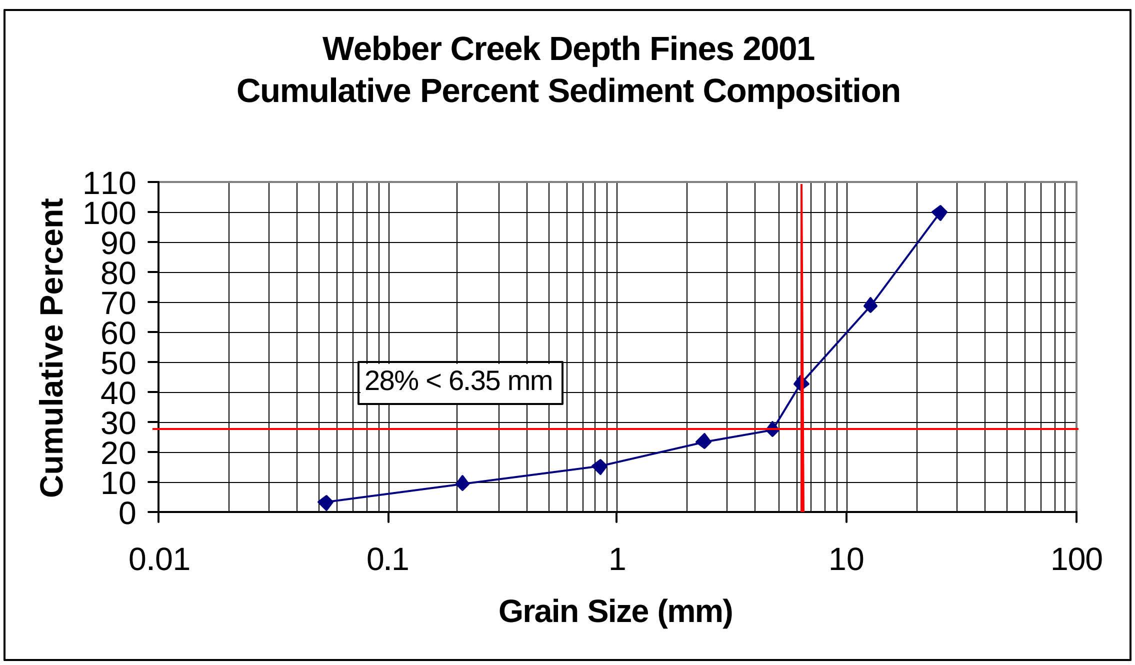
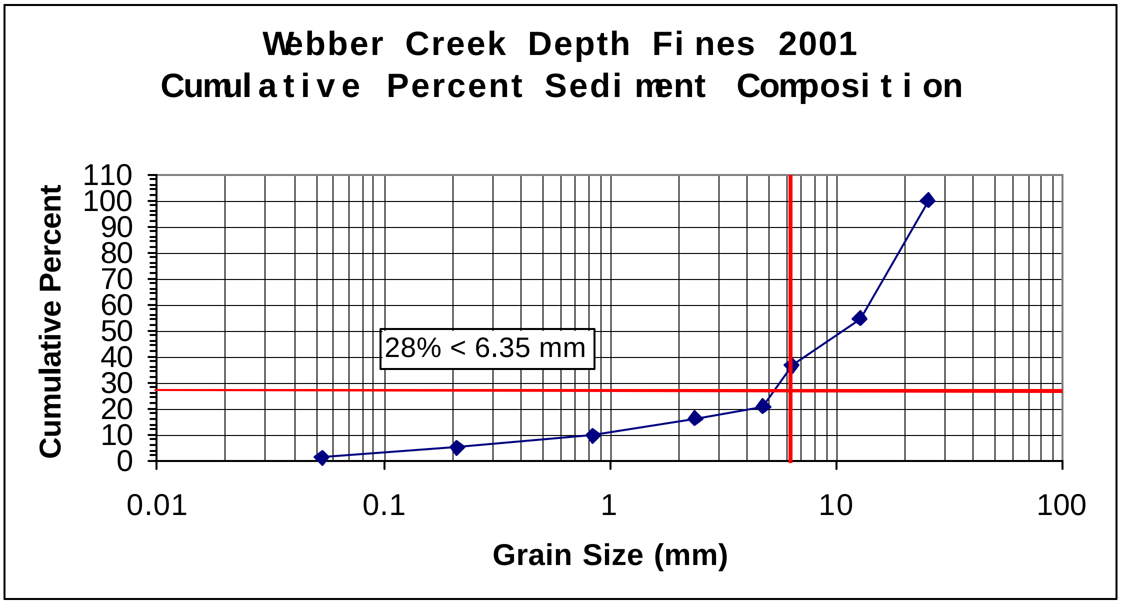


Figure 21. Webber Creek Depth Fines for 2001, Mouth



Appendix D. Streambank Erosion Inventory Methods and Results

Introduction

This appendix documents the analytical techniques and data used to develop the gross sediment budget and instream sediment measures used in calculating the sediment load allocations in this TMDL. The methods, data, and results for streambank erosion inventories and subsurface fine sediment data collection techniques are provided. These data are intended to:

1. characterize the natural and existing condition of the stream channels and riparian zones;
2. estimate the desired level of erosion and sedimentation; and
3. provide baseline data to track the effectiveness of TMDL implementation.

The streambank erosion inventories and sediment data collection techniques can be repeated and ultimately provide an adaptive management or feedback mechanism.

Streambank Erosion Inventory

The streambank erosion inventory used to estimate background and existing streambank erosion followed methods outlined in the proceedings from the Natural Resource Conservation Service (NRCS) Channel Evaluation Workshop (1983). Using the direct volume method, Edie Creek, Irving Creek, and Medicine Lodge Creek, listed in 1998 §303(d), were surveyed to determine the extent of chronic bank erosion and estimate the needed reductions.

The NRCS stream bank erosion inventory is a field method that estimates streambank/channel stability, length of active eroding banks, and bank geometry. The streambank/channel stability inventories were used to estimate the long-term lateral recession rate. The recession rate is determined from field evaluation of streambank characteristics that are assigned a categorical rating ranging from zero to three. The rating factors and rating scores are:

Bank Stability:

Do not appear to be eroding - 0
Erosion evident - 1
Erosion and cracking present - 2
Slumps and clumps sloughing off – 3

Bank Condition:

Some bare bank, few rills, no vegetative overhang - 0
Predominantly bare, some rills, moderate vegetative overhang - 1
Bare, rills, severe vegetative overhang, exposed roots - 2
Bare, rills and gullies, severe vegetative overhang, falling trees – 3

Vegetation / Cover On Banks:

Predominantly perennials or rock-covered - 0
Annuals / perennials mixed or about 40% bare - 1
Annuals or about 70% bare - 2
Predominantly bare – 3

Bank / Channel Shape:

V - shaped channel, sloped banks - 0
Steep V - shaped channel, near vertical banks - 1
Vertical banks, U - shaped channel - 2
U - shaped channel, undercut banks, meandering channel - 3

Channel Bottom:

Channel in bedrock / noneroding - 0
Soil bottom, gravels or cobbles, minor erosion - 1
Silt bottom, evidence of active downcutting – 2

Deposition:

No evidence of recent deposition - 1
Evidence of recent deposits, silt bars - 0

Cumulative Rating

Slight (0-4)	Moderate (5-8)	Severe (9+)

From the Cumulative Rating, the lateral recession rate is assigned.

0.01 - 0.05 feet per year	**Slight**
0.06 - 0.15 feet per year	**Moderate**
0.16 - 0.3 feet per year	**Severe**
0.5+ feet per year	**Very Severe**

Streambank stability can also be characterized through the following definitions. The corresponding streambank erosion condition ratings from Bank Stability or Bank Condition factors are included in italics.

Streambanks are considered stable if they do not show indications of any of the following features:

- ?? **Breakdown** - obvious blocks of bank broken away and lying adjacent to the bank breakage. *Bank Stability Rating 3*
- ?? **Slumping or false bank** - bank has obviously slipped down, cracks may or may not be obvious, but the slump feature is obvious. *Bank Stability Rating 2*
- ?? **Fracture** - a crack is visibly obvious on the bank indicating that blocks of the bank are about to slump or move into the stream. *Bank Stability Rating 2*

- **Vertical and eroding** - the bank is mostly uncovered and the bank angle is steeper than 80 degrees from the horizontal. *Bank Stability Rating 1*

Streambanks are considered covered if they show any of the following features:

- Perennial vegetation ground cover is greater than 50 percent. *Vegetation/Cover Rating 0*
- Roots of vegetation cover more than 50 percent of the bank (deeply rooted plants such as willows and sedges provide such root cover). *Vegetation/Cover Rating 1*
- At least 50 percent of the bank surfaces are protected by rocks of cobble size or larger. *Vegetation/Cover Rating 0*
- At least 50 percent of the bank surfaces are protected by logs of 4-inch diameter or larger. *Vegetation/Cover Rating 1*

Streambank stability is estimated using a simplified modification of Platts and others (1983) as stated in *Monitoring Protocols to Evaluate Water Quality Effects of Grazing Management on Western Rangeland Streams* (Bauer and Burton 1993). The modification allows for measuring streambank stability in a more objective fashion. The lengths of banks on both sides of the stream throughout the entire linear distance of the representative reach are measured and proportioned into four stability classes as follows:

- **Mostly covered and stable (non-erosional)** - streambanks are over 50 percent covered as defined above. Streambanks are stable as defined above. Banks associated with gravel bars having perennial vegetation above the scourline are in this category. *Cumulative Rating 0 - 4 (slight erosion) with a corresponding lateral recession rate of 0.01 - 0.05 feet per year.*
- **Mostly covered and unstable (vulnerable)** - streambanks are over 50 percent covered as defined above. Streambanks are unstable as defined above. Such banks are typical of ? false banks" observed in meadows where breakdown, slumping, and/or fracture show instability yet vegetative cover is abundant. *Cumulative Rating 5 - 8 (moderate erosion) with a corresponding lateral recession rate of 0.06 - 0.2 feet per year.*
- **Mostly uncovered and stable (vulnerable)** - streambanks are less than 50 percent covered as defined above. Streambanks are stable as defined above. Uncovered, stable banks are typical of streambanks trampled by concentrations of cattle. Such trampling flattens the bank so that slumping and breakdown do not occur even though vegetative cover is significantly reduced or eliminated. *Cumulative Rating 5 - 8 (moderate erosion) with a corresponding lateral recession rate of 0.06 - 0.2 feet per year.*
- **Mostly uncovered and unstable (erosional)** - streambanks are less than 50% Covered as defined above. They are also Unstable as defined above. These are bare eroding streambanks and include ALL banks mostly uncovered, which are at a steep angle to the water surface. *Cumulative Rating 9+ (severe erosion) with a corresponding lateral recession rate of over 0.5 feet per year.*

Streambanks were inventoried to quantify bank erosion rate and annual average erosion. These data were used to develop a quantitative sediment budget to develop the load allocation.

Site Selection

The first step in the bank erosion inventory is to identify key problem areas. Streambank erosion tends to increase as a function of watershed area (NRCS 1983). As a result, the lower stream segments of larger watersheds tend to be problem areas. These stream segments tend to be alluvial streams commonly classified as response reaches, Rosgen (1996) B and C channel types.

Because it is often unrealistic to survey every stream segment, representative reaches were used and bank erosion rates are extrapolated over a larger stream segment. The length of the reach to be sampled is a function of stream type variability where streams segments with highly variable channel types need a large sample, whereas segments with uniform gradient and consistent geometry need less. The IDEQ typically inventories between 10 and 30 percent of streambank. Often, the location of some stream inventory reaches is more dependent on land ownership than watershed characteristics. For example, private landowners are sometimes unwilling to allow access to stream segments within their property.

Stream reaches are subdivided into sites with similar channel and bank characteristics. Breaks between sites are made where channel type and/or dominate bank characteristics change substantially. In a stream with uniform channel geometry, there may be only one site per stream reach, whereas in an area with variable conditions there may be several sites. The subdivision of stream reaches is at the discretion of the field crew leader.

Field Methods

Streambank erosion or channel stability inventory field methods were originally developed by the US Forest Service (Pfankuch 1975). Later inventory methods of channel stability are outlined in Lohrey (1989) and NRCS (1983). As stated above, the NRCS (1983) document outlines field methods used in this inventory. However, slight modifications to the field methods are documented.

Field crews typically consist of two to four people who are trained as a group to ensure quality control or consistent data collection. Field crews survey selected stream reaches measuring bank length, slope height, bankfull width and depth, and bank content. In most cases, a global positioning system (GPS) is used to locate the upper and lower boundaries of inventoried stream reaches. Additionally, while surveying field crews photograph essential problem areas.

Bank Erosion Calculations

The direct volume method is used to calculate average annual erosion rates for a given stream segment based on bank recession rate determined in the survey (NRCS 1983). The erosion rate (tons/mile/year) is used to estimate the total bank erosion of the selected stream corridor. The direct volume method is summarized in the following equations:

$$E = [A_E * R_{LR} * ?_B]/2000 \text{ (lbs/ton)}$$

where:

E = bank erosion over sampled stream reach (tons/yr/sample reach)

A_E = eroding area (ft^2)

R_{LR} = lateral recession rate (ft/yr)

? ? ? ? ? $?_B$ = bulk density of bank material (lbs/ft^3)

The bank erosion rate (E_R) is calculated by dividing the sampled bank erosion (E) by the total stream length sampled:

$$E_R = E/L_{BB}$$

where:

E_R = bank erosion rate (tons/mile/year)

E = bank erosion over sampled stream reach (tons/yr/sample reach)

L_{BB} = bank to bank stream length over sampled reach

Total bank erosion is expressed as an annual average. However, the frequency and magnitude of bank erosion events are greatly a function of soil moisture and stream discharge (Leopold and others 1964). Because channel erosion events typically result from above average flow events, the annual average bank erosion value is considered a long term average. For example, a 50-year flood event might cause five feet of bank erosion in one year and over a ten-year period this event accounts for the majority of bank erosion. These events have less of an influence where bank trampling is the major cause of channel instability.

The *eroding area* (A_E) is the product of linear horizontal bank distance and average bank slope height. Bank length and slope heights are measured while walking along the stream channel. Pacing is used to measure horizontal distance, and bank slope heights are continually measured and averaged over a given reach or site. The horizontal length is the length of the right or left bank, not both. Typically, one bank along the stream channel is actively eroding, as in the bank on the outside of a meander. However, both banks of channels with severe headcuts or gullies will be eroding and are to be measured separately and eventually summed.

Determining the *lateral recession rate* (R_{LR}) is one of the most critical factors in this methodology (NRCS 1983). To facilitate consistent data collection, the

NRCS developed rating factors used to estimate lateral recession rate. Similar to methods developed by Pfankuch (1975), the NRCS method measures bank and channel stability, and then uses the ratings as surrogates for bank erosion rates. The IDEQ developed recession rates using the NRCS methods.

The *bulk density* ($?_B$) of bank material is measured ocularly in the field. Soil bulk density is the weight of material divided by its volume, including the volume of its pore spaces. A table of typical soil bulk densities can be used, (NRCS 1983) or soil samples can be collected and soil bulk density measured in the laboratory. Copies of the streambank erosion inventory worksheets for Edie Creek, Irving Creek, and Medicine Lodge Creek are provided on the following pages.

Edie Creek Streambank Erosion Condition Inventory (November 2000)														
Reach	Length (ft)	Stream Length (ft)	Bank Height (ft)	Soils	Bulk Density	Bank Stability	Bank Condition	Vegetation or Cover	Bank & Channel Shape	Channel Bottom	Deposition	Erosion Severity	Lateral Recession Rate (ft/yr)	Erosion Rate (Tons)
E1	2468	4936	1	silty clay loam	87.4	1	0.5	0.5	0.5	1	0.5	**Slight**	**0.050**	**10.8**
E2	8230	16460	2	silty clay loam	87.4	1	0.5	0.5	1.5	1	0.5	**Slight**	**0.058**	**83.8**
E3	3227	6454	1	silty clay loam	87.4	3	1.5	0.5	2	1	0	**Moderate**	**0.201**	**56.7**
	2.6	Miles	Percent of stream with a Slight Erosion Problem					**18%**						**151.3**
			Percent of stream with a Moderate Erosion Problem					**82%**						
			Percent of stream with a Severe Erosion Problem					**0%**						
						Total Percent of Stream assessed		100%						

Irving Creek Streambank Erosion Condition Inventory (November 2000)Remainder																		
Reach	Length (ft)	Stream Length (ft)	Bank Height (ft)	Soils	Bulk Density	Bank Stability	Bank Condition	Vegetation or Cover	Bank & Channel Shape	Channel Bottom	Deposition	Erosion Severity	Total	Slight Erosion Length	Moderate Erosion Length	Severe Erosion Length	Lateral Recession Rate (ft/yr)	Erosion Rate (Tons)
I1	12187	24374	2	silty clay loam	87.4	1	1.5	1	2	1.5	0.5	**Moderate**	7.5	0	12187	0	**0.171**	**364.8**
I2	2131	4262	4	silty clay loam	87.4	0.5	0.5	0	2	1.5	0	**Slight**	4.5	2131	0	0	**0.055**	**41.0**
I3	3411	6822	7	silty clay loam	87.4	1	1	1	2	1	0	**Moderate**	6.0	0	3411	0	**0.096**	**201.0**
EI	4475	8950	3	silty clay loam	87.4	1	0	0	2	1	0	**Slight**	4.0	4475	0	0	**0.050**	**58.7**
	4.2	Miles	Percent of stream with a Slight Erosion Problem					**30%**						**6606**	**15598**	**0**		**665.4**
			Percent of stream with a Moderate Erosion Problem					**70%**										
			Percent of stream with a Severe Erosion Problem					**0%**										
					Total Percent of Stream assessed			100%										

Medicine Lodge Creek Streambank Erosion Condition Inventory (June-August of 2000)-Eroding Banks																
Reach	Length (ft)	Bank Height (ft)	Soils	Bulk Density	Bank Stability	Bank Condition	Vegetation or Cover	Bank & Channel Shape	Channel Bottom	Deposition	Erosion Severity	Total	Slight Erosion Length	Moderate Erosion Length	Severe Erosion Length	Lateral Recession Rate (ft/yr)	Erosion Rate (Tons)
M1&M2	730	4.5	Sandy Loam	93.7	2	1.5	1	2	1	0.5	**Moderate**	8.0	0	730	0	**0.20**	**30.9**
M3	654	5	Sandy Loam	93.7	2	1	1	2	1	0	**Moderate**	7.0	0	654	0	**0.14**	**22.0**
M4-A	256	4.5	Silt Loam	87.4	3	1	1	3	1	0	**Severe**	9.0	0	0	256	**0.30**	**15.1**
M4-B&M5-A	245	4	Silt Loam	87.4	1	0	0	2	1	0	**Slight**	4.0	245	0	0	**0.05**	**2.1**
M6-A	150	4	Silt Loam	87.4	1	0	0	2	1	1	**Slight**	5.0	0	150	0	**0.06**	**1.5**
M6-B	660	5	Silt Loam	87.4	3	2	2	3	1	0	**Severe**	11.0	0	0	660	**0.37**	**52.9**
M7	491	2.5	Silt Loam	87.4	2	2	1	2	1	0	**Moderate**	8.0	0	491	0	**0.20**	**10.8**
M8-A	1,992	4	Silt Loam	87.4	3	2	2	3	1	1	**Severe**	12.0	0	0	1992	**0.40**	**139.3**
M8-C	675	3.5	Silt Loam	87.4	3	2	2	2	1	0	**Severe**	10.0	0	0	675	**0.33**	**34.4**
M9	100	5	Silt Loam	87.4	2	1	3	1	1	0	**Moderate**	8.0	0	**100**	0	**0.20**	**4.4**
M10-A	620	4	Silt Loam	87.4	3	2	1	2.5	1	0.5	**Severe**	10.0	0	0	620	**0.33**	**36.1**
M10-B	2,438	4	Silt Loam	87.4	2	2	3	2	2	0	**Severe**	11.0	0	0	2438	**0.37**	**156.3**
M11	936	3	Silt Loam	87.4	3	2	2	2	1	0	**Severe**	10.0	0	0	936	**0.33**	**40.9**
M12-A	480	4.5	Silt Loam	87.4	3	2	2	2	1	0	**Severe**	10.0	0	0	480	**0.33**	**31.5**
M12-B	1,593	4.5	Silt Loam	87.4	2	3	3	2	2	0	**Severe**	12.0	0	0	1593	**0.40**	**125.3**
M13	1,258	4.5	Silt Loam	87.4	3	1	1	2	1	1	**Severe**	9.0	0	0	1258	**0.30**	**74.2**

Medicine Lodge Creek Streambank Erosion Condition Inventory (June-August of 2000)-Eroding Banks																	
Reach	Length (ft)	Bank Height (ft)	Soils	Bulk Density	Bank Stability	Bank Condition	Vegetation or Cover	Bank & Channel Shape	Channel Bottom	Deposition	Erosion Severity	Total	Slight Erosion Length	Moderate Erosion Length	Severe Erosion Length	Lateral Recession Rate (ft/yr)	Erosion Rate (Tons)
M14	290	4.5	Silt Loam	87.4	3	1	1	2	1	0	**Moderate**	8.0	0	290	0	**0.20**	**11.5**
	2.6	Percent of stream with a Slight Erosion Problem					**2%**						**245**	**2415**	**10908**		**789.2**
		Percent of stream with a Moderate Erosion Problem					**18%**										
		Percent of stream with a Severe Erosion Problem					**80%**										
				Total Percent of Stream assessed			100%										

Medicine Lodge Creek Streambank Erosion Condition Inventory (June-August of 2000)-Rest of Banks

Reach	Length (ft)	Stream Length (ft)	Bank Height (ft)	Soils	Bulk Density	Bank Stability	Bank Condition	Vegetation or Cover	Bank & Channel Shape	Channel Bottom	Deposition	Erosion Severity	Total	Slight Erosion Length	Moderate Erosion Length	Severe Erosion Length	Lateral Recession Rate (ft/yr)	Erosion Rate (Tons)
M1&M2	8,939	17878	1.5	Sandy Loam	93.7	0.5	0.5	0	2	1	0.5	**Slight**	4.5	8939	0	0	**0.055**	**69**
M3	8,975	17950	2	Sandy Loam	93.7	0	0	0	2	1	0	**Slight**	3.0	8975	0	0	**0.040**	**67**
M4-A	2,173	4346	2.5	Silty Loam	87.4	3	1	1	3	1	0	**Severe**	9.0	0	0	2173	**0.300**	**142**
M4-B&M5-A	5,622	11244	2.5	Silty Loam	87.4	1	0	0	2	1	0	**Slight**	4.0	5622	0	0	**0.050**	**61**
M5-B	3,445	6890	1.5	Sandy Loam	93.7	0	1	0	0	0	0	**Slight**	1.0	3445	0	0	**0.020**	**10**
M6-A	6,846	13692	2.5	Silty Loam	87.4	1	0	0	2	1	1	**Slight**	5.0	0	6846	0	**0.058**	**87**
M6-B	8,514	17028	2.5	Silty Loam	87.4	0	0	0	3	1	0	**Slight**	4.0	8514	0	0	**0.050**	**93**
M7	7,509	15018	1	Silty Loam	87.4	0	0	1	1	1	0	**Slight**	3.0	7509	0	0	**0.040**	**26**
M8-A	5,004	10008	2.5	Silty Loam	87.4	2	0.5	0	2	1	1	**Moderate**	6.5	0	5004	0	**0.119**	**130**
M8-C	7,906	15812	2	Silty Loam	87.4	1	0	0	2	1	0	**Slight**	4.0	7906	0	0	**0.050**	**69**
M9	8,810	17620	2.5	Silty Loam	87.4	0	0	0	1	0	1	**Slight**	2.0	8810	0	0	**0.030**	**58**
M10-A	4,706	9412	2.5	Silty Loam	87.4	0.5	0	0	1	1	0.5	**Slight**	3.0	4706	0	0	**0.040**	**41**
M10-B	7,000	14000	2.5	Silty Loam	87.4	1	0.5	0	1	1	0	**Slight**	3.5	7000	0	0	**0.045**	**69**
M11	11,340	22680	1.5	Silty Loam	87.4	1	0	0	1	1	0	**Slight**	3.0	11340	0	0	**0.040**	**59**
M12-A	7,836	15672	2.5	Silty Loam	87.4	1	0	0	1	1	1	**Slight**	4.0	7836	0	0	**0.050**	**86**

Medicine Lodge Creek Streambank Erosion Condition Inventory (June-August of 2000)-Rest of Banks																			
Reach	Length (ft)	Stream Length (ft)	Bank Height (ft)	Soils	Bulk Density	Bank Stability	Bank Condition	Vegetation or Cover	Bank & Channel Shape	Channel Bottom	Deposition	Erosion Severity	Total	Slight Erosion Length	Moderate Erosion Length	Severe Erosion Length	Lateral Recession Rate (ft/yr)	Erosion Rate (Tons)
M12-B	6,807	13614	2.5	Silty Loam	87.4	2	0.5	0	2	2	0	**Moderate**	6.5	0	6807	0	**0.119**	**177**
M13	5,760	11520	2	Silty Loam	87.4	1	0	1	1	1	0	**Slight**	4.0	5760	0	0	**0.050**	**50**
M14	3,216	6432	2	Silty Loam	87.4	1	0	0	1	0	0	**Slight**	2.0	3216	0	0	**0.030**	**17**
M15	3,599	7198	1	Silty Loam	87.4	1	0	0	3	1	0	**Slight**	5.0	0	3599	0	**0.058**	**18**
M16	5,536	11072	1	Silty Loam	87.4	1	0	0	2	0	0	**Slight**	3.0	5536	0	0	**0.040**	**19**
M17	8,004	16008	1	Silty Loam	87.4	1	1	0	2	0	1	**Slight**	5.0	0	8004	0	**0.058**	**41**
M18	1,122	2244	1	Silty Loam	87.4	1	1	0.5	2	1	1	**Moderate**	6.5	0	1122	0	**0.119**	**12**
	26.3	Miles	Percent of stream with a Slight Erosion Problem					**76%**						**105114**	**31382**	**2173**		**1,402.4**
			Percent of stream with a Moderate Erosion Problem					**23%**										
			Percent of stream with a Severe Erosion Problem					**2%**										
					Total Percent of Stream assessed			100%										

Appendix E. Temperature Collection Sites

Hobo Placement for the Medicine Lodge Drainage

Hobo's programmed to begin collecting data on 6-15-2000 at 10:30 am
Recorded temperature every 2.5 hours
Collected on October 17, 2000

Crooked Creek (2)
#81405, up near the U.S.F.S. boundary
11 N 32 E sec 28, SW of the SW
Lat = 44 degrees 14 minutes 45.17 seconds
Long = 112 degrees 42 minutes 55.0 seconds
Elevation (meters) = 1921.2
Description of placement: At the side road fence just above the second cattlegaurd by Nicholia Canyon.

#81403, lower by the "ranch"
10 N 32 E sec 3, SE
Description of placement: at the fence, at the first gate
DIDN'T WORK

Deep Creek (1)
#81378
11 N 33 E sec 27, NE of the NW
Lat = 44 degrees 15 minutes 32.9 seconds
Long = 112 degrees 34 minutes 7.3 seconds
Elevation (meters) = 1829.7
Description of placement: 100 meters above pond, 10 meters above big rocks in pool

Divide Creek (1)
#81392, higher up on U.S.F.S. land where it won't go dry
13 N 32 E Sec 7, SW of the SW
Lat = 44 degrees 27 minutes 46.0 seconds
Long = 112 degrees 45 minutes 7.5 seconds
Elevation (meters) = 2179.3
Description of placement: 10 m above fence at road crossing, hooked to a rock
REACH WENT DRY DURING SAMPLING PERIOD

Edie Creek (2)
#81387, one at confluence
12 N 33 E sec 17, SW of the NE
Lat = 44 degrees 22 minutes 7.8 seconds
Long = 112 degrees 36 minutes 7.8 seconds
Elevation (meters) = 1889.2
Description of placement: On east side of road, hooked onto a rock at the culvert. The rock is right in front of the culvert with the hobo dangling inside of the culvert.

#74511, at the BLM boundary
12 N 33 E sec 3, SW of the NW
Lat = 44 degrees 23 minutes 52.4 seconds
Long = 112 degrees 34 minutes 25.5 seconds
Elevation (meters) = 2038.2
Description of placement: Up above road crossing where the road forks (one fork goes through creek). Hobo is hooked to an old wooden diversion gate above the 1st cottonwood up river from the road crossing on the west side of the river.

Fritz Creek (2)
#81383, at forks
13 N 32 E sec 32, NE of the NE
Lat = 44 degrees 24 minutes 54.2 seconds
Long = 112 degrees 43 minutes 2.6 seconds
Elevation (meters) = 2107.4
Description of placement: Where the braiding begins, on the left braid 30 meters above the forks (South Fork dry)

#74453, at the confluence
13 N 32 E sec 26, SE of the NW
Lat = 44 degrees 25 minutes 36.9 seconds
Long = 112 degrees 39 minutes 56.6 seconds
Elevation (meters) = 1992.2
Description of placement: 200 meters above mouth at fence

Horse Creek (1)
#74521, at the confluence
13 N 32 E sec 26, NE of the NW
Lat = 44 degrees 25 minutes 43.9 seconds
Long = 112 degrees 40 minutes 13.4 seconds
Elevation (meters) = 1995.8
Description of placement: 40 meters below the Divide Creek road crossing

Indian Creek (2)
#81402, high on west fork
13 N 34 E sec 34, SE of the SE
Lat = 44 degrees 24 minutes 20.8 seconds
Long = 112 degrees 26 minutes 24.9 seconds
Elevation (meters) = 2133.6
Description of placement: Drive along the west fork until you hit the U.S.F.S. boundary. There is a brown sign with an up arrow and a number 205 that marks the F.S. boundary. Just past the cattle guard there is an old wood fence. Follow the fence down to the river. The hobo is hooked to the fence post on the east side of the river and hidden under debris and rocks.

#81388, below forks
We could not get to this area due to private property

Irving Creek (3)
#81399, at the confluence
13 N 32 E sec 36, NW of the SE
Lat = 44 degrees 24 minutes 31.33 seconds
Long = 112 degrees 38 minutes 37.6 seconds
Elevation (meters) = 1965.7
Description of placement: Hobo is hooked onto a rock at the confluence upriver from the culvert about 4 feet, right in the middle of the creek.

#81398, East Fork
13 N 33 E sec 21, NE of the NW
Lat = 44 degrees 26 minutes 41.0 seconds
Long = 112 degrees 35 minutes 7.3 seconds
Elevation (meters) = 2158.6
Description of placement: Drive up road past the cattlegaurd with the BLM sign on it, and follow that fence down to river. Hobo is attached to a cottonwood right upriver from the fence on the roadside of the creek.

#81382, above the forks
13 N 33 E sec 17, SW of the SW
Lat = 44 degrees 26 minutes 48.2 seconds
Long = 112 degrees 36 minutes 43.3 seconds
Elevation (meters) = 2094.9
Description of placement: Go through the Angielen Ranch and over cattlegaurd. Turn right at the BLM boundary. 20 feet above the fence marking the BLM boundary the hobo is hooked onto a root mass on the South side of the river and is tucked under the root mass.

Medicine Lodge Creek (3)
#81391, at Small
10 N 35 E sec 5 SW of the SW
Lat = 44 degrees 13 minutes 2.62 seconds
Long = 112 degrees 22 minutes 30.9 seconds
Elevation (meters) = 1603.2
Description of placement: hobo placed on the south side of the bridge on the main road at Small. Hobo is hooked to the fence post on the SW side of creek.

#81390, at Spring Hollow Creek
12 N 33 E sec 33, NE of the NE
Lat = 44 degrees 19 minutes 40.3 seconds
Long = 112 degrees 34 minutes 45.4 seconds
Elevation (meters) = 1829.1
Description of placement: 14 miles up MLC from Small, the hobo is placed at an abandoned log house with outbuildings with a Teton Regional Land Trust Conservation Easement sign on the

fence. This abandoned house is also about 1 mile downriver from Spring Hollow Creek. If you walk through the gate to the river there is a tree on the North side of the creek. The hobo is hooked to a rock and laid in the river about 1/3 of the way across, parallel to the tree.

#81404, at the bridge above Middle Creek
11 N 34 E sec 22, NE of the NE
Lat = 44 degrees 18 minutes 56.34 seconds
Long = 112 degrees 28 minutes 25.6 seconds
Elevation (meters) = 1809.3
Description of placement: About 40 feet above the Middle Creek culvert there is a lone tree on the roadside of the creek. There is an opening in the grass and rock embankment down to the river where the hobo has been hooked to a rock on the side of the river.

Middle Creek (2)
#81385
12 N 34 E sec 29, SE of the NE
Lat = 44 degrees 20 minutes 25.7 seconds
Long = 112 degrees 28 minutes 40.5 seconds
Elevation (meters) = 1858.4
Description of placement: From Indian creek we took the road over to Middle to the gate. Down river from the gate there is an old wooden walking bridge. The hobo is placed under a cottonwood, which is about 100 feet downstream from the bridge at the first bend in the creek from the bridge. The hobo is on the downstream side of the tree.

#81397, at the confluence
11 N 34 E sec 15, SE of the SE
Lat = 44 degrees 18 minutes 56.57 seconds
Long = 112 degrees 28 minutes 24.6 seconds
Elevation (meters) = 1809.6
Description of placement: Below the culvert on the south side of the MLC road. The hobo is attached to a root on the east side of the culvert.

Warm Creek (1)
#81393, up past the "ranch"
13 N 32 E sec 22, NE of the NW
Lat = 44 degrees 26 minutes 43.4 seconds
Long = 112 degrees 41 minutes 26.5 seconds
Elevation (meters) = 2041.2
Description of placement: Go to the campground above the ranch (campground has fire ring and BLM wire box). Walk upriver and at the third bend in the river above the campground there is a very large boulder. The hobo is hooked onto a rock at the center of the creek close to the boulder and hidden under the long grass inside of creek.

Warm Springs Creek (1)
#81395, up near the springs
11 N 32 E sec 36, NE of the NW

Lat = 44 degrees 14 minutes 38.4 seconds
Long = 112 degrees 38 minutes 50.3 seconds
Elevation (meters) = 1888.8
Description of placement: Upper end of the second campground above the U.S.F.S. boundary

Webber Creek (3)
#81396-0225, past U.S.F.S. at trailhead (2 hobo's placed together for QA)
12 N 32 E sec 15, SW of the SW
Lat = 44 degrees 21 minutes 48.0 seconds
Long = 112 degrees 41 minutes 17.9 seconds
Elevation (meters) = 2108.3
Description of placement: 10 meters above trail sign, dead log on right bank.

#81381, at confluence
12 N 33 E sec 17, SE of the NW
Lat = 44 degrees 22 minutes 12.8 seconds
Long = 112 degrees 36 minutes 18.8 seconds
Elevation (meters) = 1892.5
Description of placement: 80 meters above the mouth, 10 meters below fence on right bank.

Appendix F. Draft Implementation Plan

DRAFT

Medicine Lodge Creek Subbasin Total Maximum Daily Load Implementation Plan for Agriculture

Medicine Lodge Creek Subbasin Total Maximum Daily Load Implementation Plan for Agriculture

Developed for the

Idaho Department of Environmental Quality

Prepared by
Elliot Traher
Water Quality Resource Conservationist
Idaho Association of Soil Conservation Districts
St. Anthony, Idaho
In
Cooperation with Clark Soil and Water Conservation District

April 2002

IASCD
IDAHO ASSOCIATION OF
Soil Conservation
Districts

Table of Contents

Tables and Figures

Acronyms:

AFO - Animal Feed Operation.

BMP - Best Management Practice.

BPA - Bonneville Power Administration.

CRP - Conservation Reserve Program.

EPA - Environmental Protection Agency.

EQIP - Environmental Quality Incentives Program.

FSA - Environmental Quality Incentives Program.

HIP - Habitat Improvement Program.

IASCD - Idaho Association of Soil Conservation Districts.

ICA - Idaho Cattle Association.

IDEQ - Idaho Department of Environmental Quality.

ISCC - Idaho Soil Conservation Commission.

ISDA - Idaho State Department of Agriculture.

NRCS - Natural Resources Conservation Service.

MOU - Memorandum of Understanding.

CSWCD - Clark Soil and Water Conservation District.

RCRDP - Resource Conservation and Rangeland Development Program.

RMS - Resource Management System.

SAWQP - State Agricultural Water Quality Program.

TMDL - Total Maximum Daily Load**.**

TU - Treatment Unit.

UI-CES - University of Idaho, Cooperative Extension System.

USGS - United States Geological Survey**.**

WQLS - Water Quality Limited Segment**.**

Introduction

Purpose

The purpose of this plan is to recommend BMPs that would improve or restore physical, chemical, and biological functions for Medicine Lodge, Edie, Fritz, and Irving creeks. This plan will satisfy the requirements described in Idaho Code 39-3601. This plan will build upon past conservation accomplishments that have been made and will assist and/or compliment other subbasin efforts in restoring beneficial uses.

Goals and Objectives

The goal of the agricultural component of the Medicine Lodge Subbasin TMDL Implementation Plan is to restore cold-water biota and salmonid spawning beneficial uses in streams on private agricultural lands. The purpose of this document is to identify the BMPs that will be needed to meet the requirements of the TMDL. The implementation plan identifies BMPs to treat approximately 38 miles of streams within the subbasin. This includes more than 1,650 acres of riparian area that need to be treated.

The objectives of this plan include the following:

- Improve riparian and stream channel habitat
- Reduce stream channel erosion
- Improve grazing management
- Decrease sediment, nutrient and bacteria concentrations
- Reduce livestock concentration on streams
- Eliminate runoff from AFOs
- Monitor project progress and apply adaptive management

Beneficial Use Status

Medicine Lodge Creek, Edie Creek, Irving Creek, and Fritz Creek are on the State of Idaho's 1998 303(d) list of water quality impaired water bodies. Medicine Lodge Creek (WQLS# 2206) is listed from Spring Hollow to the town of Small, Idaho. Edie Creek (WQLS# 2210) is listed from its headwaters to Medicine Lodge Creek. Irving Creek (WQLS# 2211) is listed from its headwaters to Medicine Lodge Creek and Fritz Creek (WQLS# 2212) is listed from Forks to Medicine Lodge Creek. Approximately 35 miles of creeks are listed. Beneficial uses that exist on these creeks include cold-water biota, salmonid spawning, primary contact recreation, secondary contact recreation, and agricultural water supply. Historic impacts within the subbasin have impaired the beneficial uses of Medicine Lodge Creek and its tributaries. The identified problems in the subbasin according to the IDEQ are shown in Table 1.

Table 1. Beneficial Use Support Status of Water Quality Limited Segments (IDEQ 2002)

Stream	WQLS#	Pollutant	Support Status	Concerns
Edie Creek	2210	**Flow Alteration & Sediment**	**Not full support**	**Improper Grazing & Stream Bank Erosion**
Fritz Creek	2212	Nutrients & Temperature	**Not full support**	**AFOs & Stream Bank Erosion**
Irving Creek	2211	**Habitat Alteration, Nutrients & Sediment**	**Not full support**	**Improper Grazing Management, Stream Bank Erosion**
Medicine	2206	**Flow Alteration, Sediment & Temperature**	**Not full support**	**Stream Bank Erosion, Unstable Diversions, Lack of vegetation, AFOs**

The subbasin's TMDL is scheduled for 2004, however extensive inventories and monitoring have already been completed within the subbasin providing agencies a window of opportunity to develop an early TMDL for the subbasin. A proactive approach is being taken by the CSWCD, CDWAG, IDEQ, ISCC, IASCD, and NRCS to address water quality problems for the subbasin.

Project Setting

The Medicine Lodge Creek Subbasin (USGS Hydrologic Unit Code 17040215) is located in northwestern Clark County and is 15 miles west of Dubois, Idaho. The subbasin consists of six subwatersheds, Edie, Fritz, Irving, Indian, Middle, and Medicine Lodge. The subbasin drains approximately 16,195 acres or 25 square miles. Approximately 72% of the land within the subwatersheds are privately owned. Rangeland is the predominant land use within the subwatersheds at 78% of the acres. Elevations range from 9,000 feet at Fritz Peak to 5,000 feet where Medicine Lodge Creeks disappears into the ground.

The subbasin, shown in Figure 1, is a semi-arid steppe with many miles of ephemeral and intermittent drainages. Streams within the subbasin incorporate flow from natural steady thermal springs, to receiving snowmelt directly from the Beaverhead Mountain Range. The subbasin's principal drainage is Medicine Lodge Creek. The headwaters begin at the confluence of Warm and Fritz creeks and then flows approximately 21 miles in a southeasterly direction slightly past the town of Small. The creek then dissipates from diversions and naturally sinks into the channel bed directly above the aquifer northwest of Cedar Butte (BLM 2001).

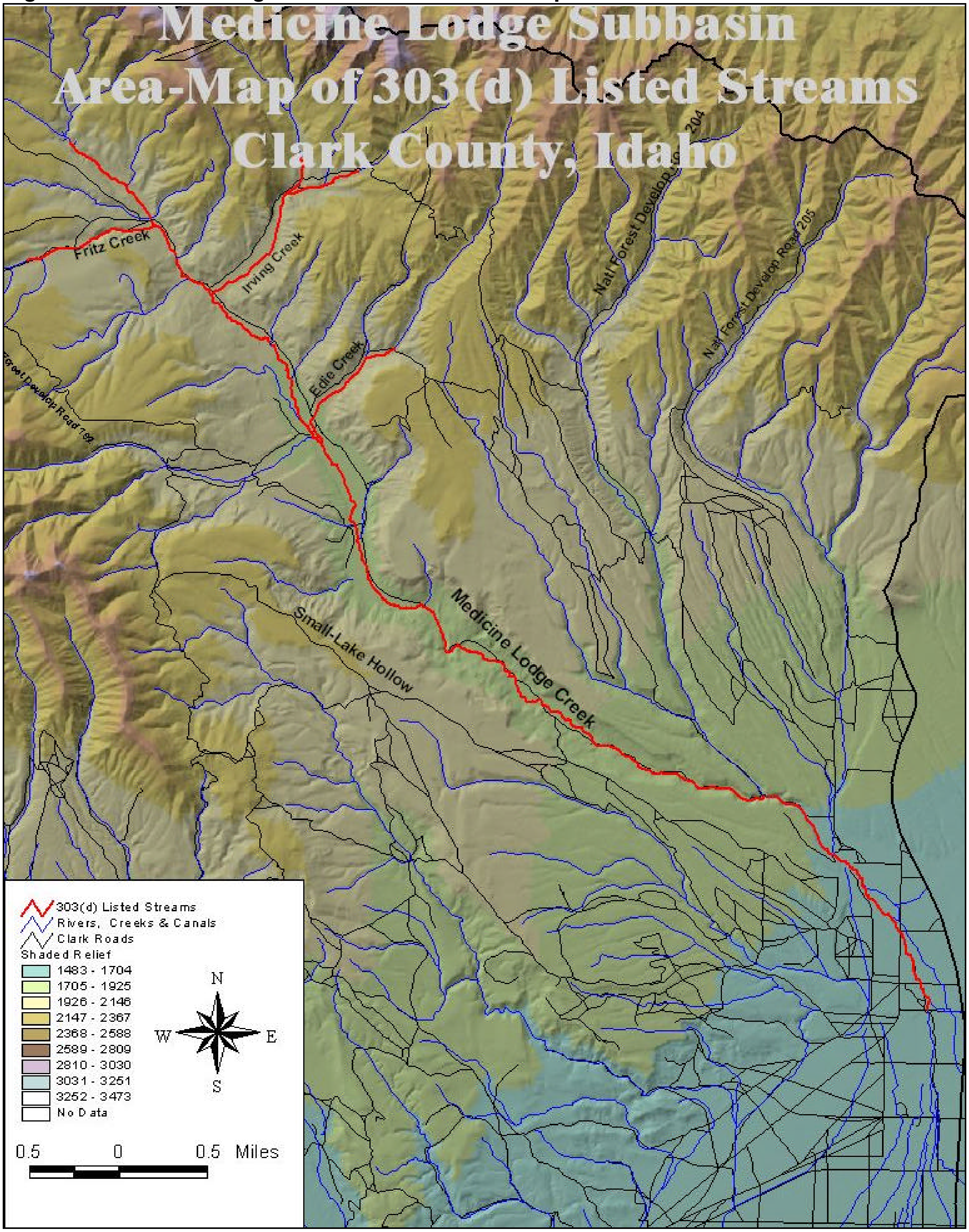
Accomplishments

Several conservation practices have been implemented within the subbasin as shown in Table 2. Most of the projects have focused on agricultural irrigation diversions, irrigation efficiency and prescribed grazing protection. Recently, five additional landowners have applied for assistance to install approximately 485 acres of riparian forest buffer with livestock exclusions through the C-CRP.

Table 2. Completed BMP Projects & Practices in the Medicine Lodge Creek Subbasin.

Target Stream	Acres Treated	Site Type	Work Type	Project Benefits	Program
Medicine Lodge Creek	127	Upland Instream	Irrigation & Grazing Modification	Water Conservation, Riparian Protection, Wildlife Enhancement, Pasture & Hay Land Management	LTA
Medicine Lodge Creek	237	Upland Instream	Irrigation & Grazing Modification	Water Conservation, Wildlife Enhancement, Pasture & Hay Land Management	RCRDP & LTA
Medicine Lodge Creek	2,100	Uplands	Grazing Modification	Wildlife Enhancement, Pasture & Hay Land Management	LTP & LTA
Medicine Lodge Creek	2,041	Uplands	Grazing Modification	Wildlife Enhancement, Pasture & Hay Land Management	LTA
Weber Creek	1,832	Uplands	Grazing Modification	Wildlife Enhancement, Pasture & Hay Land Management	CRMP
Weber Creek	10	Instream	Streambank Stabilization	Bank Erosion Reduction & Irrigation Water Conservation	CRMP
Middle Creek	39	Riparian	Irrigation & Diversion Modification	Water Conservation, Riparian Protection, Wildlife Enhancement & Fish Passage	ACP-ANA
Weber Creek	318	Upland	Grazing Modification	Riparian Protection, Wildlife Enhancement, Pasture & Hay Land Management	CRMP
Medicine Lodge Creek	500	Instream	Fencing & Streambank Stabilization	Riparian Protection, Bank Erosion Reduction	RCRDP

Figure 1. Medicine Lodge Creek Subbasin Area Map



Problem Identification

Pollutants of Concern

The following pollutants were identified on the 1998 § 303(d) list as responsible for, or contributing to, impaired water quality conditions in the Subbasin: nutrients, sediment, flow alteration, habitat alteration, and temperature (IDEQ 2002). Sediment was identified as a pollutant affecting four segments, nutrients affected three segments, temperature affected two segments, habitat alteration affected two segments, and flow alteration affected one segment. All of the identified pollutants in this subbasin originate as nonpoint sources. There are no industrial or municipal point sources of discharge. However seven animal feeding operations have been identified on Medicine Lodge Creek and it tributaries.

There are no state water quality criteria that pertain to flow alteration or habitat alteration, and it is DEQ's policy that TMDLs will not be developed for these pollutants. Among the assumptions used to compile Idaho's 1998 § 303(d) list, DEQ asserts that flow alteration and habitat alteration are 1) not defined by the Clean Water Act as pollutants, and 2) unsuitable for TMDL development (DEQ 1998). The capacity of a waterbody to support aquatic life is initially determined by the presence of water and secondarily by the quality of that water. However, the relationship between flow apportionment and water quality is clearly addressed in Idaho's water quality standards (IDAPA 58.01.02.050.01) as follows;

> The adoption of water quality standards and the enforcement of such standards is not intended to conflict with the apportionment of water to the state through any of the interstate compacts or decrees, or to interfere with the rights of Idaho appropriators, either now or in the future, in the utilization of the water appropriations which have been granted them under the statutory procedure…

Identified Problems

Based on the findings from the ICBEMP, water temperature, sediment, nutrients and stream flow alterations were the most common causes of water quality impairment (Quigley, Arbelbibe, et, al, 1997). Additional findings from BLM address current and historical conditions within the subbasin.

> *"Based on historical accounts and personal communications, many of the tributary streams to Medicine Lodge Creek long ago had extensive beaver dam complexes and ponds that provide abundant fishing opportunities. Today the hydrologic regime is altered with these streams experiencing down cutting and gullying, with a lower water table stressing and reducing remnant riparian wetland vegetation. Beaver removal, dredging, and draining of wetlands, irrigation withdrawals, improper grazing, combined with natural high flow events have all contributed to the present condition. This present condition of the stream channel compared to the earlier prevalence of beaver-dominated systems is still affecting the hydrologic regime and sediment delivery." (BLM 2001)*

Current land use practices, and structures in the subbasin are definitely contributing to the degradation of beneficial uses. The inventories completed by the NRCS and SCC clarifies that removal of vegetation and canopy cover, unstable diversions, and culverts, road encroachment, concentrated livestock feeding and watering areas are underlying factors. IDEQ presumes that beneficial uses were or would be fully supported between current and natural background loading rates. There is no data at this time that can determine what load that may be. Therefore the strategy is to establish a no net trend in load capacities through best management practices improving land use management and restoring beneficial uses. The proposed implementation will focus on four streams in the subbasin, which are on the State of Idaho's 1998 §303(d) list.

Temperature
The temperature load that can be assimilated by any of the stream segments in the subbasin without violating water quality standards or impairing beneficial uses is unknown.

Nutrients
The nutrient load that can be assimilated by any of the stream segments in the subbasin without violating water quality standards or impairing beneficial uses is unknown.

Flow Alteration
There are no state water quality criteria that pertain to flow alteration and it is DEQ's policy that TMDLs will not be developed for these pollutants.

Habitat Alteration
There are no state water quality criteria that pertain to habitat alteration, and it is DEQ's policy that TMDLs will not be developed for these pollutants.

Sediment
The sediment load that can be assimilated by any of the stream segments in the subbasin without violating water quality standards or impairing beneficial uses is unknown. Sediment reductions for individual reaches were assessed and estimated. The following table describes the sediment reductions and reveals segments of concern within the subbasin.

Table 3. Stream Bank Erosion Estimates for Medicine Lodge, Edie, Fritz & Irving Creeks.

Creek	Reach	Inventoried Length (ft)	Percent Inventoried	Existing Erosion (tons/year)	Desired Erosion (tons/year)	Percent Reduction
Edie Creek	E1	5,280	100%	11	11	0
	E2	16,896	100%	347	72	79
	E3	6,336	100%	126	13	90
Fritz Creek	F1	3,168	100%	6	6	0
	F2	6,336	100%	20	20	0
	F3	8,448	100%	19	19	0
	F4	5,280	100%	11	11	0
Irving Creek	I1	24,604	100%	893	118	87
	I2	4,858	100%	72	45	37
	I3	10,560	100%	968	148	85
	EI	9,504	100%	93	64	31
Medicine Lodge Creek	MLC1	17,952	100%	138	76	45
	MLC2	19,008	100%	125	73	42
	MLC3	4,752	100%	157	27	83
	MLC4	12,144	100%	63	63	0
	MLC5	12,000	100%	10	10	0
	MLC6	10,600	100%	367	76	79
	MLC7	17,952	100%	146	100	32
	MLC8	15,734	100%	50	29	42
	MLC9	12,672	100%	516	77	85
	MLC10	1,000	100%	0	0	0

	MLC11	16,896	100%	69	69	0
	MLC12	18,162	100%	92	63	32
	MLC13	10,560	100%	51	42	18
	MLC14	19,008	100%	105	75	29
	MLC15	24,288	100%	215	80	63
	MLC16	16,790	100%	127	91	28
	MLC17	16,896	100%	544	87	84
	MLC18	13,728	100%	175	65	63
	MLC19	6,864	100%	91	29	68
	MLC20	7,392	100%	102	16	85
	MLC21	10,560	100%	19	19	0
	MLC22	15,840	100%	169	35	79
	MLC23	2,112	100%	34	5	84

Stream Assessment Methods

Documenting Field Observations
At each reach, the teams completed field sheets. Photos were taken at the beginning and end of each reach to document conditions during the assessment. Every eroding bank was photographed and measured, inventories were completed on every 303 (d) listed stream in the sub basin, and reference sites were established for future monitoring.

Delineating Stream Reaches
The streams were divided into reaches using soils, geology, slope, sinuosity, vegetation, hydrology, roads, drainage area, valley type and land use. Elevations, slopes, stream order, and sinuosity were determined from 1:24,000 scale DRGs, DLGs and DEMs. The streams in the subwatersheds were compiled from 1:12,000 scale DOQs. Reaches are shown in Figure 2.

Assessing Aquatic Habitat Suitability
SVAP provides a simple procedure to evaluate the condition of a stream based on visual characteristics. The protocol provides an overall assessment of the condition of the stream and riparian ecosystems, identifies opportunities to enhance biological value, and conveys information on how streams function and the importance of protecting or restoring stream and riparian areas (NRCS 1998). SVAP is a qualitative method that includes 14 ranking factors and corresponding numeric values, which are then averaged to rate the reach’s condition, as shown in Table 4. Eleven ranking factors are required while three factors are ranked only when applicable. Currently, NRCS requires the use of SVAP when assessing aquatic habitat and recommends that a "fair" condition be achieved as a minimum for conservation plan implementation (NRCS 2001).

Table 4. SVAP Conditions and Average Score Ranges (NRCS 1998)

SVAP Condition	Average Score
Poor	0 to 6.0
Fair	6.1 to 7.4
Good	7.5 to 8.9
Excellent	9.0 to 10.4

Estimating Stream Erosion
SECI estimates long-term stream erosion rates. This method produces an index by ranking six factors; bank stability, bank condition, bank cover, channel shape, channel bottom and deposition. The teams used

SECI to estimate erosion on the entire reach. Eroding sections, not similar to the entire reach's erosion condition, were measured and ranked separately from the rest of the reach. Stream erosion rates are estimated by applying LRRs to bank height and bank length measurements as shown in Table 5. SECI was used for comparison rather than absolute erosion rates in a sediment budget (NRCS 2000).

Table 5. SECI Conditions, Index and LRR Ranges (NRCS 2000)

SECI Condition	Index Range	LRR Range
Slight	0 to 4	0.01 to 0.05 ft/yr
Moderate	5 to 8	0.06 to 0.15 ft/yr
Severe	9 to 12	0.16 to 0.30 ft/yr
Very Severe	12 to 15	0.30 to 0.50 ft/yr

Stream Assessment Results

Summarizing the Assessment Results

CSWCD and NRCS requested permission to conduct the stream assessment. The private landowners granted the team access to all 303(d) listed streams within the subbasin. NRCS, ISCC, and IASCD began the assessment on June 5th, 2000 and finished on August 15th, 2000. The interdisciplinary team assessed approximately 38 miles of streams within the subbasin. Results for each reach are shown in Table 6. About 29 miles of Medicine Lodge Creek, 2.6 miles of Edie Creek, 2.2 miles of Fritz Creek and 4.8 miles of Irving Creek were assessed. The combined SVAP and SECI scores of the assessed reaches are shown in Figure 2. The different protocols allowed the reaches to be evaluated based upon habitat suitability and erosion condition.

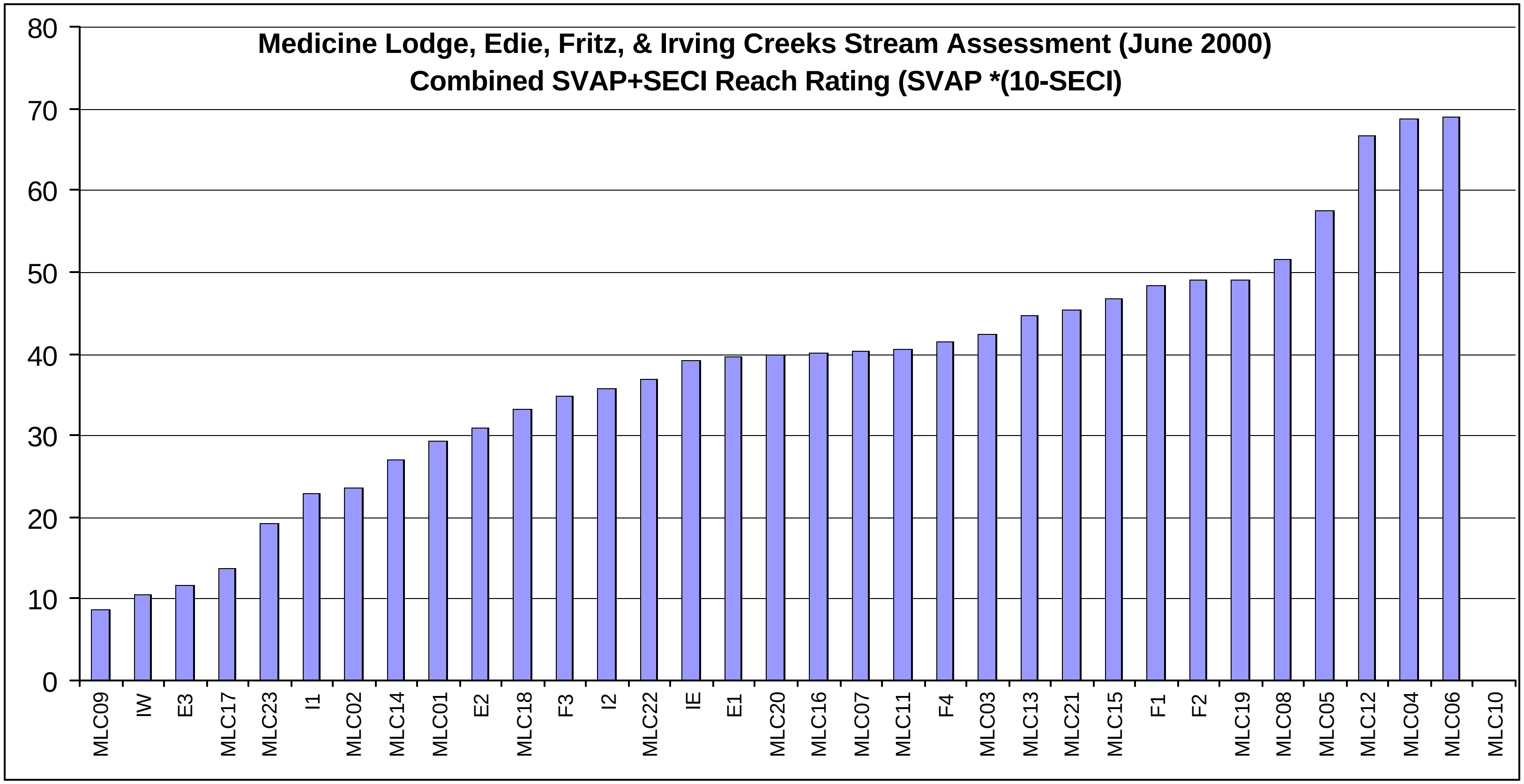
Table 6. Medicine Lodge, Edie, Fritz and Irving Creeks Assessment Summary

Reach	Length	SVAP	SECI Category	Erosion Rate*	Erosion Rate*
MLC1	1.8	Poor	Moderate	100	55
MLC2	1.8	Fair	Moderate	81	44
MLC3	0.5	Poor	Severe	157	342
MLC4	1.2	Fair	Slight	63	57
MLC5	0.7	Fair	Slight	10	15
MLC6	1.3	Fair	Moderate	89	67
MLC7	1.7	Fair	Severe	146	84
MLC8	1.5	Good	Moderate	33	22
MLC9	1.2	Poor	Severe	269	203
MLC10	0.2				
MLC11	1.6	Good	Severe	103	64
MLC12	1.7	Good	Moderate	62	37
MLC13	1.0	Fair	Severe	72	71
MLC14	1.8	Fair	Severe	217	122
MLC15	2.3	Good	Severe	93	40
MLC16	1.6	Fair	Severe	117	74
MLC17	1.6	Poor	Severe	302	190
MLC18	1.3	Fair	Severe	124	94
MLC19	0.7	Fair	Moderate	28	43
MLC20	0.7	Good	Moderate	18	27
MLC21	1.0	Fair	Slight	17	16

MLC22	1.5	Fair	Moderate	41	27
MLC23	0.2	Poor	Moderate	12	55
E1	0.5	Fair	Slight	10.8	23
E2	1.6	Fair	Moderate	84	54
E3	0.6	Fair	Moderate	57	92.7
F1	0.3	Fair	Slight	6	18
F2	0.6	Fair	Slight	20	37
F3	0.8	Poor	Slight	19	23
F4	0.5	Fair	Slight	11	21
I1	2.3	Poor	Moderate	370	158
I2	0.5	Good	Severe	72	154
IW	1.0	Poor	Severe	522	509
IE	0.9	Fair	Severe	94	98
Total	**38 miles**			**3,419 tons/yr**	**2,937 tons/mile/yr**

Erosion Rate = (Stream Length) * Bulky Density * Lateral Recession R

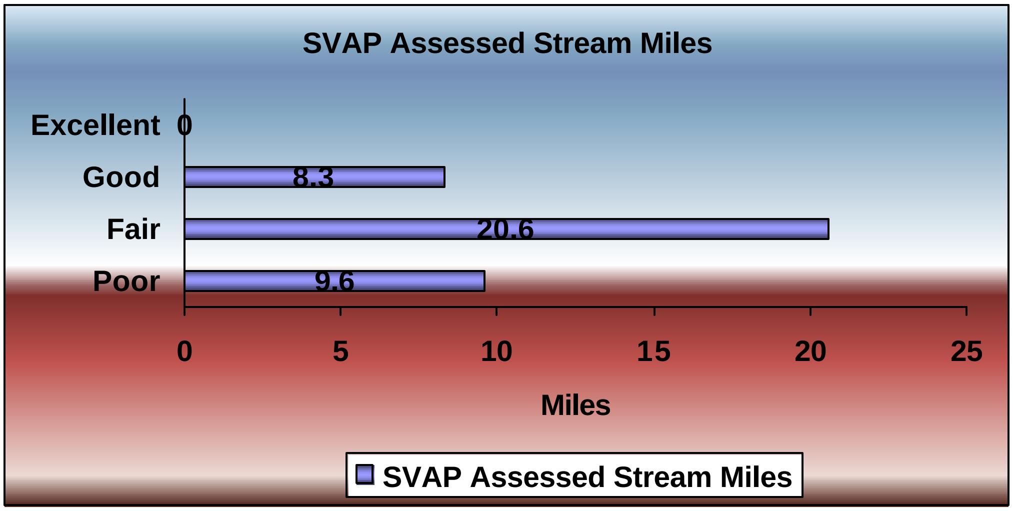
Figure 2. Medicine Lodge, Edie, Fritz and Irving Creeks SVAP/SECI Combined Chart



SVAP Results

SVAP results show that 25% or 9.6 miles of the assessed reaches were in poor condition, 53% or 20.6 miles of the assessed reaches rated in fair condition, while 22% or 8.3 miles of the assessed reaches rated in good condition and 0% rated in excellent condition. These results are Figure 4.

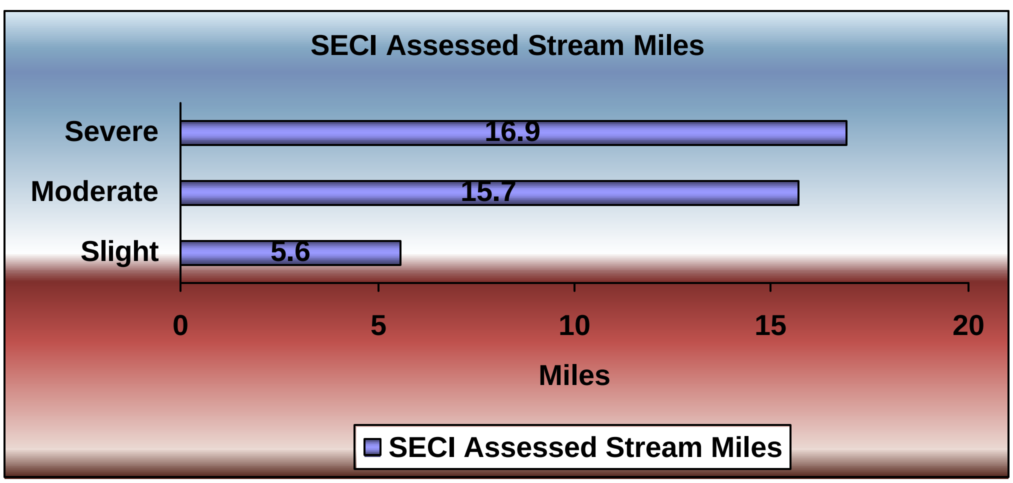
Figure 3. Percent of Assessed Stream Miles for SVAP Rating Categories



SECI Results

SECI results reveal that of the 38 miles of assessed stream miles about 15% or 5.6 miles had slight erosion. While 41% or 15.7 miles rated in moderate erosion condition and 44% or 16.9 miles rated in the severe erosion category. These results are shown in Figure 5.

Figure 4. Percent of Assessed Stream Miles for SECI Categories



Critical Areas

Areas of agricultural lands that contribute excessive pollutants to water bodies are defined as "Critical Areas" for BMP implementation. Critical areas are prioritized for treatment based on their location to a water body of concern and the potential for pollutant transport and delivery to the receiving water body. Agricultural critical areas in all of the listed stream segments within the subbasin are:

✍✍Unstable and erosive streambed or banks

✍✍Unstable irrigation diversion structures
✍✍Areas of channelization or vegetation removal
✍✍Animal Feed Operations

Tiers

There were two tiers delineated within the subbasin. These tiers were determined by the proximity of the critical areas to the §303(d) listed stream segments. Critical areas and tier amounts are shown in Table 7.

Tier 1 Unstable and erosive streambanks and riparian areas or facilities adjacent to the stream that have a direct and substantial influence on the stream.

Tier 2 Pasture and rangelands or AFOs with an indirect, yet significant influence on the stream.

Table 7. Critical Areas by Subwatershed within the Medicine Lodge Subbasin

	TMDL Implementation Tier 1		TMDL Implementation Tier 2	
Subwatershed	**Riparian**	**AFO**	**Pasture Land**	**Range Land**
Eddie Creek	118		17	1,000
Fritz Creek	96	2	0	428
Irving Creek	204		350	1,129
Medicine Lodge Creek	1,252	5	4,065	6,946
Totals	1,670		5,864	9,503

Animal Feed Operations

National Definition: The term "animal feeding operation" or AFO is defined in EPA regulations as a "lot or facility" where animals "have been, are, or will be stabled or confined and fed or maintained for a total of 45 days or more in any 12-month period and crops, vegetation, forage growth, or post-harvest residues are not sustained in the normal growing season over any portion of the lot or facility."

The Idaho Legislature passed the Beef Cattle Environmental Control Act in the spring of 2000. Governor Kempthorne then signed this Act in April 2000. ISDA then went into a rule making process and on September 18, 2000, the “Rules of the Department of Agriculture Governing Beef Cattle Animal Feeding Operations” (IDAPA 02.04.15) became effective. Subsequent to the rules becoming effective, a Memorandum of Understanding (MOU) was written and signed by ISDA, IDEQ, ICA, and EPA in January 2001. The MOU gave ISDA authority to regulate beef cattle feeding operations that fall under the definitions of IDAPA 02.04.15 not located on Indian Reservations (ISDA 2000).

Threatened and Endangered Species

According to the Medicine Lodge Subbasin Assessment written by IDEQ, there are three species of salmonids in the Medicine Lodge Drainage. These include Yellowstone cutthroat (*Oncorhynchus clarki*), Brook trout (*Salvelinus fontinalis*) and Rainbow trout (*Oncorhynchus mykiss*). The Yellowstone Cutthroat is considered a state sensitive species in Idaho and is carefully managed by the IDFG. In 1998, it was petitioned to become a threatened species, but after review in February 2001, the USFWS declined the petition to list the Yellowstone Cutthroat under the Endangered Species Act. Medicine Lodge Creek also contains non-salmonid species of fish, including the Short-headed Sculpin (*Cottus confusus*), which are found in the majority of the tributaries as well as the main stem of Medicine Lodge Creek. Western Mosquito fish (*Gambusia affinis*), a warm water species, have also been found in Warm Springs Creek and have obviously been introduced although there are no records of this (NRCS 2002 Tech Guide).

According to the USFWS, there are two threatened species in Clark County, the Grizzly bear (*Ursus arctos horribilis*) and the Bald eagle (*Haliaeetus leucocephalus*). The Gray wolf (Canis lupus) is the only species listed as endangered in Clark County. The Gray wolf is considered experimental/non-essential under section 10(j) of the Endangered Species Act. Under these circumstances, Federal action agencies are required to confer with the USFWS if their actions are likely to jeopardize the continued existence of Gray wolves as well as any other species listed as threatened or endangered (NRCS 2002 Tech Guide).

Proposed Treatment

Treatment Units

The TUs describe areas with similar use, productivity, resource concern and treatment needs. These not only provide a method for delineating and describing land use but are also used to evaluate land use impacts to water quality and in the formulation of alternatives for solving identified problems. TUs are geographically shown in Figure 5.

Treatment Unit #1 Middle Main Stem

Acres	Soils	Description	Resource Problems
122	Soils consist of very deep, well-drained soils formed in alluvium with some loess and silty alluvium. Slopes are from 0-45% to 0-60%, permeability is moderate, with particle size ranging from silt to sand with some gravel and cobble	Straightened or manipulated channels, moderately entrenched, collapsing meanders, flat gradient, with minimal canopy cover.	Sediment from bank erosion Head cutting from failing culverts Bank trampling from livestock Unstable irrigation diversions Temperature from lack of canopy cover, Meadow dewatering from down cutting Nutrients from the livestock.

Treatment Unit #2 Lower Tributaries

Acres	Soils	Description	Resource Problems
275	Soils consist of very deep, somewhat poorly drained soils that formed in recent alluvium from welded tuff and basalt to well drained soils on mountains that formed in local alluvium or colluvium derived from limestone and loess. Permeability is from slow to moderate, slope are from 0-4% to 4-70% and the typical pedon ranges from a silt loam to a very gravelly loam.	Somewhat wide streams of low gradient (1%). Depositional areas, with high width to depth ratio. Poorly constructed irrigation diversions	Sediment from streambank erosion, livestock concentration, and failing beaver dams. Temperature increase from lack of canopy cover, downing cutting and meadow dewatering. Possible nutrient contribution from animal impact.

Treatment Unit #3 Tributaries

Acres	Soils	Description	Resource Problems
211	Soils mostly consist of very deep, well drained soil that form in alluvium from calcareous siltstone, mudstone, sandstone, quartzite, basalt and tuff. They have slopes of 4 to 7%. Soils vary from gravelly silty loams to very gravelly loams with slow to moderate permeability.	Wide streams of high gradient (2-3%). Moderately entrenched with cut banks. Fine sediment deposition and high grazing use.	Sediment from streambank erosion, livestock concentration, and failing beaver dams. Temperature increase from lack of canopy cover, downing cutting, meadow dewatering and natural warm springs. Possible nutrient contribution from animal impact.

Treatment Unit #4 Lower Main Stem

Units	Soils	Description	Resource Problems
172	Soils are very deep, well drained	Moderately	Sediment from streambank

	formed in alluvium with some loess and silty alluvium from loess influence on fan terraces, foothills and mountain slopes. Slopes are 0-60%, moderate permeability, with a typical pedon consisting of a gravelly silt loam	entrenched, with flat gradients, minimal canopy cover, diversions, feedlots and animal crossing	erosion, poor/failing culverts, and failing diversion. Increase in temperature from lack of canopy cover, widening streams and meadow dewatering.

Treatment Unit #5 Upper Main Stem

Acres	Soils	Description	Resource Problems
330	Soils are very deep, well-drained formed in slope alluvium derived from calcareous siltstone, shale and some limestone. Slopes are 0-70%, moderate permeability, with a typical pedon consisting of a loam	Widening streams of low gradient (1%). Low cut banks, woody vegetation, fine sediment, and lack of pasture.	Sediment from concentrated livestock and upland area. Increase in temperature from lack of canopy cover and nutrients from concentrated grazing animals.

Treatment Unit #6 Upper Tributaries

Acres	Soils	Description	Resource Problems
200	Soils consist of very deep, well drained soils that formed in recent alluvium from welded tuff and basalt to well drained soils on mountains that formed in local alluvium or colluvium derived from limestone and loess. Permeability is from slow to moderate, slopes are from 0-4% and 4-70% and ranges from a silt loam to a very gravelly loam.	Narrow streams of low gradient. Very little in-channel sediment, with low width to depth ratio	Overgrazing resulting in decreased vegetative condition, suitability, and composition. Unstable and eroding streambanks. Sediment from failing beaver dams and poor constructed culverts. Increased water temperature. Increased bacterial contribution to the stream.

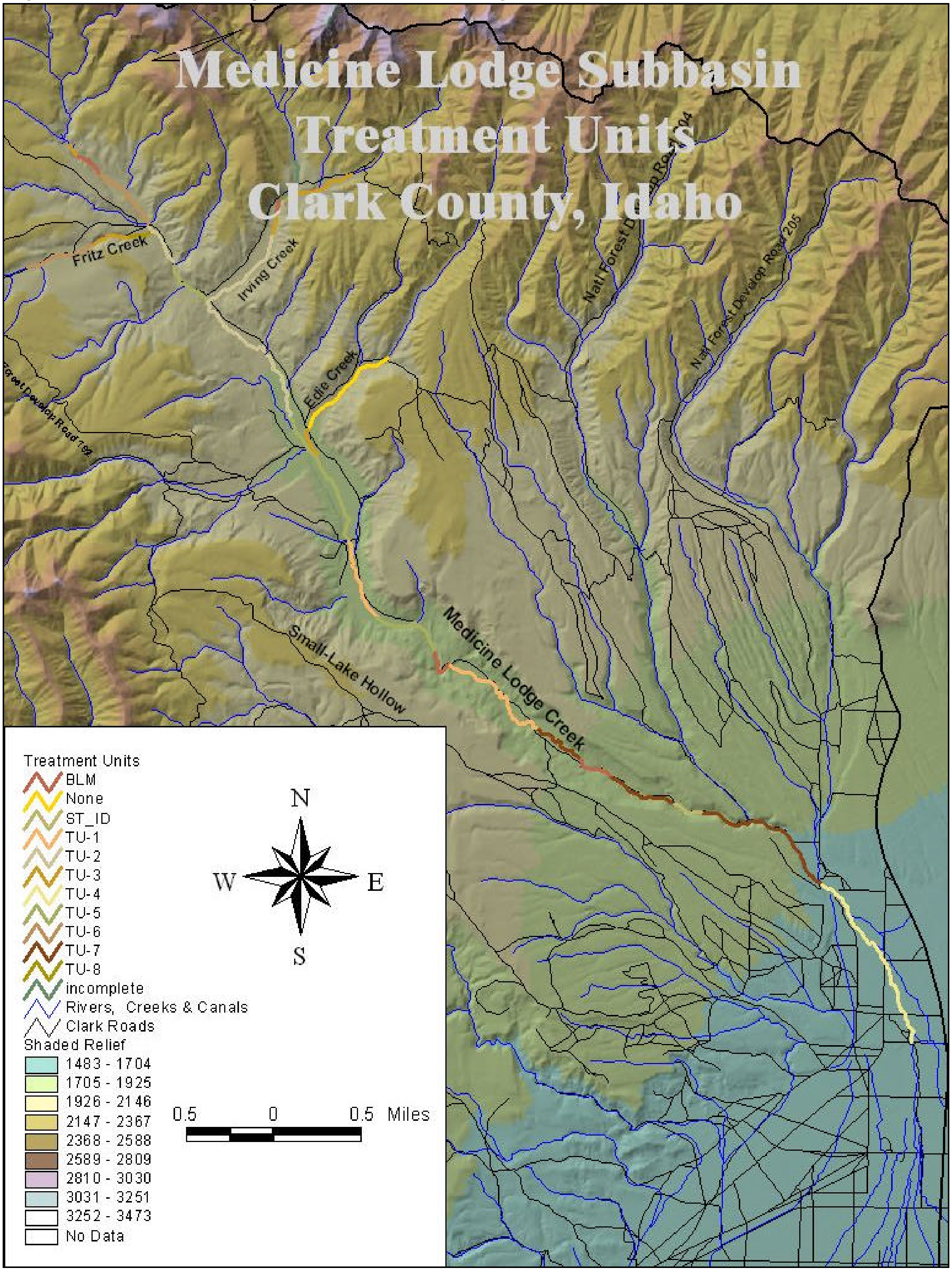
Treatment Unit #7 Main Stem

Acres	Soils	Description	Resource Problems
282	Soils are very deep, well-drained formed in slope alluvium and in calcareous loess derived from calcareous siltstone, shale, and rhyolite. Slopes are 1-70%, moderate permeability, with pedons ranging from a loam to a gravelly silt loam.	Narrow valley, straight, high canopy cover, some road encroachment, and few ox-bow cutoffs.	Sediment from road, nutrients from recreation.

Treatment Unit #8 Lower Fritz Creek

Units	Soils	Description	Resource Problems
13	Soils range from well drained and moderately deep to very deep and poorly drained. Formed from recent alluvium from mixed sources, permeability ranges from moderate to slow, slopes range from 0-12% and the typical pedon would be a silt loam.	Moderately entrenched, flat gradient, coarse soils, with no canopy cover, high width to depth ratio and large macrophyte beds.	Temperature from lack of canopy cover, from stream widening and from warm springs. Nutrients from grazing animals and possible septic.

Figure 5. Medicine Lodge, Edie, Fritz and Irving Creeks Treatment Units



BMP Implementation

The proposed treatment for sediment, nutrient and temperature reduction will be to implement BMPs through RMS conservation plans in TUs within each subwatershed. RMS plans are a combination of BMPs and is defined in Idaho's Agricultural Pollution Abatement Plan. Table 8 lists the estimated cost of BMPs.

Table 8. Total BMP Costs for the entire Medicine Lodge Subbasin (all treatment units)

Treatment Units 1-8: Middle Main Stem, Lower Tributaries, Tributaries, Lower Main Stem, Upper Main Stem, Upper Tributaries, Main Stem, Lower							
Components	**Unit Type**	**Unit Cost**	**C/S Percent**	**Unit Amount**	**C/S Funds**	**Operator Funds**	**Total Funds**
Prescribed Grazing - 528							
Prescribed Grazing System	Ac	$22.49	75%	1,134	$19,129	$6,376	$25,506
Riparian Exclusion	Ac	$74.87	75%	290	$16,284	$5,428	$21,713
Riparian Forest Buffer - 319							
Trees shrubs, Bareroot	Ft	$4.81	75%	94,409	$340,301	$113,434	$453,735
Trees Shrubs, Containerized	Ft	$2.39	75%	97,609	$175,294	$58,431	$233,726
Fence 4-Wire	Ft	$1.5	75%	204,271	$229,805	$76,601	$306,406
Streambank Protection - 580							
Vegetation Revetments	Ft	$44.52	75%	8,837	$29,508	$9,836	$39,345
Poles or Bundles	Ft	$3.00	75%	49,228	$20,763	$6,921	$27,684
Clump Planting	Ft	$10.00	75%	2,424	$18,180	$6,060	$24,240
Barbs	Each	$1,000	75%	49	$36,750	$12,250	$49,000
Toe Rock	Ft	$29.60	75%	4,200	$93,240	$31,080	$124,320
Stream channel Stabilization - 584							
Rock V-weir	Each	$1,568	75%	44	$51,750	$17,250	$69,000
Structures for Water Control							
Diversions	Each	$3,654	75%	13	$35,625	$11,875	$47,500
Diversions (concrete, pipe, fish screens)	Each	$21,250	75%	4	$63,750	$21,250	$85,000
Rock V-weirs	Ft	$1,000	75%	6	$4,500	$1,500	$6,000
Animal Trails and Walkways - 575							
Crossing	Each	$1,800	75%	5	$6,750	$2,250	$9,000
Water Facilities - 614							
Water Gaps	Each	$2,500	75%	57	$106,875	$35,625	$142,500
Water Developments	Each	$5,000	75%	10	$37,500	$12,500	$50,000
Waste Storage Facilities - 313							
Corral Dikes	Ft	$4.5	75%	1,500	$5,062	$1,687	$6,750
Corral Systems	Each	$8000	75%	4	$24,000	$8,000	$32,000
				Totals	$1,315,069	$438,356	$1,753,425

Funding

Current funding for implementation of agricultural projects is being provided through WQPA, §319, C-CRP programs. Other potential funding sources being evaluated include EQIP, RCRDP, and BPA.

Information and Outreach

The conservation partnership (CSWCD, ISCC and USDA-NRCS) will use their combined resources to provide information to agricultural landowners and operators within the subbasin. A local outreach plan will be developed by the conservation partnership. Newspaper articles, district newsletters, watershed and project tours, landowner meetings, and one on one personal contact will be used as outreach tools. Outreach efforts will:

- Provide information about the TMDL process.
- Provide water quality monitoring results.
- Accelerate the development of conservation plans and program participation.
- Provide progress reports.
- Enhance technology transfer related to BMP implementation.
- Increase awareness of agriculture’s contribution to conserve and enhance natural resources.
- Increase the public's awareness of agriculture's commitment to meeting the TMDL challenge.

Evaluation an Monitoring

Evaluation and monitoring will be an integral component of this implementation plan. At the field level the ISCC and USDA-NRCS will complete annual status reviews in cost-share programs such as EQIP, CRP, WQPA, RCRDP, and §319. In addition, the ISCC will complete BMP effectiveness evaluations through out the implementation phase. The ISCC has an established BMP evaluation format and process that will be implemented in conjunction with the annual status reviews. Evaluation protocols have been developed for many water quality BMPs and component practices. Should the situation arise where an appropriate protocol is lacking, the ISCC will work with agencies such as USDA-NRCS, UI-CES, IDEQ, and CSWCD to develop the needed protocol.

At the subbasin level, ISDA and IASCD water quality analysts will provide water quality monitoring. The CSWCD plans to coordinate with IASCD and ISDA in developing a water quality BMP effectiveness-monitoring plan for the entire subbasin. Currently, monitoring is being conducted by the IDEQ. Efforts to develop a monitoring plan have already begun. It is anticipated the plan will be finalized by June 1, 2002 with actual monitoring soon after.

Table 9. Action items to be completed in the Medicine Lodge Subbasin

Priority Subwatershed	Action Item	Completion Date
1. Medicine Lodge Creek	Outreach efforts for example projects, tours and newsletters	
	Complete conservation plans with project contracts	
2. Irving Creek	Outreach efforts for example projects, tours and newsletters	
	Complete conservation plans with project contracts	
	Ongoing surveys and inventories for the west fork	
3. Fritz Creek	Outreach efforts for example projects, tours and newsletters	
	Complete conservation plans with project contracts	
4. Edie Creek	Complete conservation plans with project contracts	
	Outreach efforts for example projects, tours and newsletters	

References

IDEQ. Idaho Department of Environmental Quality, 2002. Medicine Lodge Subbasin TMDL: An allocation of nonpoint source pollutants in the water quality limited watersheds of the Medicine Lodge Subbasin. 19 pp. Idaho Falls, Idaho.

IDEQ. Idaho Department of Environmental Quality, 1999. Lemhi River Watershed TMDL: An allocation of nonpoint source pollutants in the water quality limited watersheds of the Lemhi River valley. 54 pp. Idaho Falls, Idaho.

IBLM. Idaho Bureau of Land Management. 2001. Medicine Lodge Subbasin Review. 8-10 pp. Idaho Falls, Idaho.

ISDA. Idaho State Department of Agriculture. 2001. The Idaho Beef Cattle Environmental Control Memorandum of Understanding. 7 pp. Boise, Idaho.

ISDA. Idaho State Department of Agriculture. 2000. Beef Cattle Animal Feeding Operation Program. 3 pp. Boise, Idaho.

NRCS. Natural Resources Conservation Service. 1983. Erosion and sediment yield. In: Proceedings from the Channel Evaluation Workshop. Ventura, CA.

Lehman, Bob. 2001. Personal communication. Engineer, USDA-NRCS. Rexburg Idaho, Idaho.

Kotansky, Dan. 2001. Personal communication. Hydrologist, BLM. Idaho Falls, Idaho.

Appendix G. Public Comments

Public comment for the Medicine Lodge Subbasin Assessment and TMDL began August 7, 2002 and ended September 6, 2002. A request for comments appeared in the the Idaho Falls Post Register on August 7, 2002. There were several meetings prior to the comment period with the Medicne Lodge Watershed Advisory Group. The most recent meeting was held September 2, 2002, just prior to the end of the public comment period.

In addition, the Medicine Lodge Subbasin Assessment and TMDL was distributed to EPA, BLM, USFS, Idaho Fish and Game, and the NRCS for review. Comments were received from EPA Region 10 and the Forest Service, Caribou-Targee National Forest, Dubois Ranger District.

Comments from Jayne Carlin, EPA Region 10, Watershed Restoration Unit

Sediment Loading Analysis

1. **Comment:** IDEQ linked stream bank erosion to stream bank stability. Stream bank stability was used as a surrogate for the sediment TMDL, with the target of 80% stream bank stability. Then, IDEQ developed quantitative load allocations and reductions based on the data obtained from stream bank erosion surveys. Although IDEQ provided the stream bank assessment summaries, the IDEQ failed to describe the protocol used in obtaining this data or provide the actual data.
   Recommendation: The TMDL document would be improved if IDEQ included the stream bank erosion methods and results (Stream Bank Erosion Inventory Worksheets) as an appendix to the TMDL.

   Response: *DEQ has added Appendix E to the Medicine Lodge Creek TMDL which contains streambank erosion inventory monitoring methods and results used in the development of this TMDL.*

Margin of Safety

2. **Comment:** IDEQ stated that the temperature TMDL has an implicit Margin of Safety (MOS) in that the MOS is inherent in the state's water quality standards (WQS) for temperature. The MOS is intended to account for uncertainty in the TMDL and the calculations within the TMDL to ensure that allocations will lead to the attainment of the WQS. Therefore, any conservatism which may be within the WQS cannot be counted as a margin of safety to attain the WQS.
   Recommendation: Include an explanation for the margin of safety which meets the intent and purpose of the MOS.

   Response: *The explanation of MOS has been modified to reflect that the MOS was factored into the the temperature TMDLs by basing the TMDLs on the maximum temperatures exceedances observed in each stream. If the maximum exceedances are* *eliminated, it is likely that other exceedances observed during the critical time periods will be eliminated also.*

3. **Comment:** IDEQ states that the sediment TMDL's margin of safety (MOS) is implicit based on conservative assumptions used to develop existing sediment loads: 1) that the desired bank erosion rates are representative of background conditions and 2) that water quality targets for percent depth fines are consistent with values measured and set by local land management agencies based on established literature values and incorporate an adequate level of fry survival to provide for stable salmonid production. IDEQ failed to explain how the background conditions would be considered conservative. IDEQ also failed to explain whether the values based on established literature values are being set at a level which is more stringent than what would be adequate to meet the beneficial use of salmonid spawning. Was a more protective literature value chosen that would exceed an adequate level of fry survival?
   Recommendation: Include an explanation on how each of the assumptions would be considered conservative.

   Response: *DEQ provided further explanation of why the assumptions factored into the MOS for sediment TMDL load allocations are considered conservative on page 85 of this TMDL. It is expected that the beneficial uses for the sediment listed streams will be attained prior to meeting the TMDL targets in this TMDL, since the TMDL targets are based on meeting background conditions. Therefore, sediment TMDLs developed for the Medicine Lodge Subbasin are considered conservative.*

Seasonal Variations

4. **Comment:** The Clean Water Act and implementing regulations require that a TMDL be established with consideration of seasonal variations. IDEQ states, A seasonal variations in sediment loading are not considered" which implies that IDEQ did not develop the sediment TMDL with consideration of seasonal variations. Yet, the information following the above statement explains how seasonal variations were considered in the TMDL analysis.
   Recommendation: Begin seasonal variations section with a statement that IDEQ considered seasonal variations when developing the sediment TMDL and then explain how seasonal variations were considered.

   Response: *The seasonal variation for sediment was considered in this TMDL and an explanation of how seasonal variation was considered is provided on page 85. Seasonal Variation was included through streambank erosion inventory monitoring, which considers that the greatest amount of streambank recession occurs when streams are at peak flows. Peak flows for this watershed occur in the early summer months.*

5. **Comment:** In the section on seasonal variation, IDEQ does not discuss the temperature TMDLs. Therefore, it is implied that IDEQ did not consider seasonal variations when developing the temperature TMDL.

Recommendation: Include an explanation under seasonal variation on how IDEQ considered seasonal variations when developing the temperature TMDL. It appears that IDEQ incorporated seasonal variations by taking into account the critical seasons for critical life stages of fish species present and evaluating temperature at the hottest time of the year (summer) and setting TMDL in accordance with reductions needed during period where there is greatest variation between current in-stream temperature and criteria.

Response: *DEQ modified the temperature seasonal variation explanation on page 85 to describe that TMDL reductions were developed from temperature exceedances observed during the spring and summer seasons where there is the greatest exceedances and there is greatest variation between current in-stream temperature and the temperature criteria.*

6. **Comment:** Note that there are numerous typographical errors in the Executive Summary which IDEQ may want to correct before finalizing the TMDL.

   Response: *DEQ corrected typographical errors in the executive summary of this TMDL.*

Comments from Robbert Mickelsen and Mike Philbin, Caribou-Targee National Forest, Dubois Ranger District.

1. **Comment:** Page 61, the first paragraph under the status of beneficial uses says that "the majority of sites located in streams listed for sediment exceed the sediment target". However, the target is just that – a target. If beneficial uses are fully supported, even at levels above the target, than the stream should not be listed.

   The second paragraph says that the salmonid spawning temperature standard has been exceeded, but a closer review of the data (table 10) shows that most exceedances actually occurred outside the critical time periods identified on page 71. Therefore, these streams do not exceed the salmonid spawning standard (especially the reference Webber Creek).

   Response: *BURP data was not assessed for the Medicine Lodge Subbasin because this report was written between implementation of Waterbody Assessment Guidance (WBAG) 1 and WBAG2 assessment methodologies. Based on this comment, DEQ recently evaluated data collected on the streams of concern using the WBAG2 methods and verified that the streams listed did not support beneficial uses. In addition, other sediment data on the streams of concern were collected which include Depth Fines data, Surface Fines Data, Streambank Erosion Inventories, Stream Visual Assessment Protocol, and Proper Functioning Condition. The collected data supported DEQ's determination that beneficial uses are not supported for the streams of concern, hence, sediment TMDL's for Irving Creek, Edie Creek, and Medicine Lodge Creek were developed.*

   In response to the second part of this comment, Table 10 documents exceedences in temperature criteria for the spring, summer, and fall season. However, only exceedances observed during the salmonid spawning critical time periods were evaluated in Section 5 of the TMDL. The temperature targets chosen for streams within the Medicine Lodge

Subbasin are summarized on page 77 of the TMDL. These targets are what the TMDLs are based on. DEQ added a reference on page 42 to refer to Section 5 of the TMDL where salmonid spawning time periods for the subbasin were further evaluated.

2. **Comment:** The land management and regulatory agencies consider Webber Creek as the reference stream for this subbasin. As such, it doesn't make sense to list it as impaired. If fact, other streams in this subbasin should be compared to Webber Creek when assessing water quality variables. If Warm Springs Creek were delisted (for temperature) for being at its site potential, why would Webber Creek be listed for being at its site potential?

   Response: *Temperature data collected in Webber Creek exceeded temperature criteria for salmonid spawning, therefore, Webber Creek is considered not full support. In response to this comment, DEQ added that critical time periods for salmonid spawning shall be further evaluated during the implementation phase of this TMDL in Section 2.4 of the Subbasin Assessment.*

3. **Comment:** An earlier review of the temperature data raised questions regarding large diurnal fluctuation on Divide Creek. The other sites had fluctuations of about ten (10) degrees; while in Divide Creek, they were up to 20 degrees. These very large fluctuations, plus the very high temperatures (Table 25), and the extended period of exceedences (Table 25) suggest that this thermograph came out of the water. If so, listing it for exceeding the Cold Water Aquatic Life temperature standard would be incorrect. We recommend collecting additional data before taking this step.

   Response: *DEQ reevaluated the temperature data collected for Divide Creek based on this comment. Based on review of the collected data and further information that the reach was dry during the time of sampling, the TMDL for Divide Creek was removed. It is recommended that this stream be monitored for temperature when wet to determine the status of beneficial uses in Section 2.4 of the Subbasin Assessment.*

4. **Comment:** The influences of upland erosion are difficult to determine. As noted on page 69, the TMDL is supposed to provide a quantification of current pollutant loads by source. However, the document does not do this. While it raises the possibility of upland erosion by discussing soils, erosion rate, summer thunderstorms, and even improved management practices (in section 4 and the implementation plan); it never tells us how much sediment if from upland sources either in absolute terms or relatively. What are the current upland loads? Why isn't there a measure to evaluate reductions from this source – much like bank stability does for in-channel sources? While we agree upland treatments and a watershed approach are important, and feel upland treatments would benefit this watershed, a case for them has not been made in the TMDL. Therefore, we feel that strengthening the tie between upland erosion, sediment production, and treatments would greatly strengthen the document and provide better justification for the proposed implementation plan treatments.

Response: *DEQ used gross allocations of loadings since all loading sources are non-point sources in this subbasin. Information to further break down non-point source loads were not available at the time this TMDL was developed and is not required. In section 3.2 of the Subbasin Assessment, DEQ recognizes that a more detailed breakdown of pollutant sources would be of benefit and warrants further evaluation in the implementation plan.*

5. **Comment:** By not including upland or watershed sources, is there really a margin of safety? It's possible that areas receiving sediment from upland sources could meet bank stability goals, yet not meet sediment target.

   Response: *Upland sources are included in the Margin of Safety. The 80% streambank erosion inventory target combined with the 28% or less fine sediment target factors in loading sources from streambanks and other sources. The premise is that, if streambank erosion inventory targets are met but the 28% sediment target is not, it is clear that other sources, including upland sources, are contributing to the sediment loading observed.*

6. **Comment:** The sediment targets used to evaluate existing conditions may not be appropriate in many of these streams. For example, in gravel bed streams keying in on the 6.35 mm particles may cause an analyst to identify problems that don't really exist. That is, there may not be a problem, that's just what the streams are. A gravel bed stream (Rosgen B4) would naturally have a higher percentage of fine gravels (2-6.25 mm) than a boulder stream (Rosgen B2). Therefore, the same sediment target should not apply to both stream types. Until better information becomes available, we recommend using <2 mm (sand and finer) for gravel bed streams and <6.35 mm for cobble/boulder streams. Also, why are we extrapolating values from another area (in a different climatic and geologic part of Idaho) when there is a reference stream in this subbasin (Webber Creek)? The target should be based on what the physical system can provide, not just what fish want. If the extrapolated values are used, there should be a discussion on how the climate and geology of this basin differs from the area the values were obtained from. This discussion should include a conclusion regarding expected particle sizes and the amount of sediment produced in the Medicine Lodge subbasin (would it be more or less than the area the target came from?)

7. **Comment:** Is there another procedure that can be used to measure our progress towards the sediment target? McNeil sampling is more appropriate for research projects than for this type of monitoring. This technique is an expensive and time-consuming process that would result in small sample sizes. This raises the concern of sampling non-representative sites (it's hard to tell how representative a site is when the area being sampled is subsurface) and performing non-statistically significant monitoring. If research using this method is used to establish targets, all aspects of the research need to be followed to make the values meaningful. This includes sampling size and frequency. The subbasin assessment did not use a large sample size, so comparisons to most research are questionable at best. In summary, the variability of this element requires large sample sizes. Small sample sizes would make this method non-defensible. Were other methods considered, or did the TMDL go right to McNeil sampling?

8. **Comment:** If surface fines were used instead of depth fines, local reference data could be obtained from the Beaverhead-Deerlodge National Forest (BDNF). The BDNF is located just on the other side of the divide, and they have an extensive network of reference reaches. Using sites from the Beaverhead Mountains (local) would provide much better information than limited depth fines samples using extrapolated targets. Surface fines would also be a better indicator in rearing habitat (Cold Water Aquatic Life).

   Response: *The 28% or less depth fine sediment (<6.35mm) target is a benchmark used for protecting salmonid eggs deep in the riffle independent of geology and Rosgen class. It is true that some streams naturally have higher amounts of small grain size due to geology and position on the landscape. However, we believe the impacts of fine sediment over 28% reduces salmonid spawning success. In streams that are more erodable, it is more important to manage riparian areas to maintain channel geometry and reduce sediment inputs. For Example, Webber Creek, a reference stream as you say, is considered to have minimal human impact but is naturally erosive, has a 29% average of depth fines below the 6.35mm size. DEQ considers this close enough to the benchmark to be considered a background amount, which supports the sediment targets developed in this TMDL.*

   As described in Section 2.3 of the Subbasin Assessment, other sediment data was collected for the streams of concern to support the basis of the TMDL's for sediment. These include surface fines data, streambank erosion inventory, and streambank visual assessment protocol. This data collected supported DEQ's determination the sediment TMDLs for Edie Creek, Irving Creek, and Medicine Lodge Creek need development.

   Surface fines data collected within the Medicine Lodge subbasin, as summarized on page 47 of this document,was highly variable and did not show trends that could be used as part of this TMDL. In addition, surface fines have less of an effect on salmonid spawning because surface sediments can easily be swept away by the fish when they spawn. Depth fines sampling was chosen as a sediment target because sediments below the surface affect salmonid spawning and fry survival, more so than surface fines. This is not to say that surface fines data cannot be used for comparison of data obtained from the Beaverhead-Deerlodge National Forest (BDNF). Surface fines data collected in the Medicine Lodge subbasin may be used as corroborating evidence to determine if beneficial uses are being supported following implementation of this TMDL.

9. **Comment:** During previous comments, we mentioned the availability of 2001 temperature data for Fritz Creek. We also have No2+No3 and Orthophosphate data for Fritz, Irvin, Warm, Divide, and Edie Creeks from 1995. Therefore, it is incorrect to say that nutrient data does not exist for Fritz Creek. As of October 4, we will also have 2002 temperature data for Fritz and Webber Creeks.

   Response: *DEQ evaluated the most recent data collected for the evaluation on temperature and nutrients. This includes Orthophosphate and NO_2 and NO_3 data collected by the BLM in 2000 and 2000 temperature data collected on the streams of* *concern. Nutrient data collected was not included in the Subbasin Assessment since no exceedances were observed. The conclusion section of the Subbasin Assessment on page 65 was revised to more clearly state that nutrient data collected by the BLM indicates no nutrient enrichment.*

10. **Comment:** Section 4, "Summary of Past and Present pollution Control Efforts", does not include actions taken by the forest to reduce bank impacts. The main action is the construction of several enclosures along Fritz Creek.

    Response: *This information was noted in Section 4 of the Subbasin Assessment and shall be considered in the implementation phase of this TMDL.*